

Modern Refrigeration & Air Control

No. 724

JULY, 1958

1958

Price 2s. 6d. monthly

ENGINEERING
LIBRARY

LIGHTFOOT
REFRIGERATION



all
over
the
world



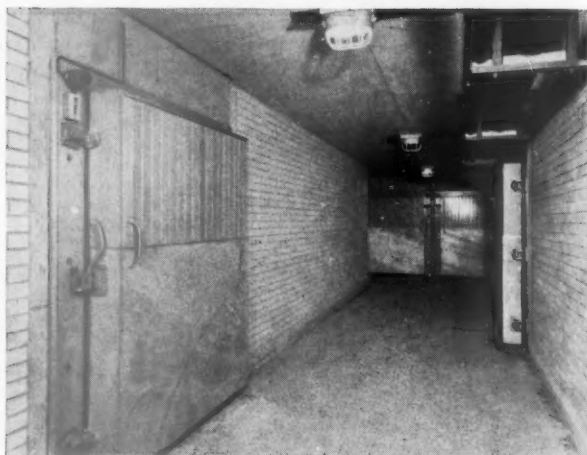
For over 70 years our name has represented that which is best and foremost in refrigeration for Commercial, Industrial and Marine purposes.

Our progressive research and development in all fields of design and application ensure continuity of that reliability and economical operation of refrigerating plant for which we are famed throughout the world.

LIGHTFOOT
REFRIGERATION CO. LTD
100, WIMBORNE, WIMBORNE
100, WIMBORNE, WIMBORNE
100, WIMBORNE, WIMBORNE



THE NEW SOUTHAMPTON COLD STORE



Destroyed by the Luftwaffe, and
rebuilt, with insulation by
Taylor's of Mitcham

New Cold Stores for International
Cold Storage & Ice Co. Ltd., to the
order of British Transport Commission,
in co-operation with
Messrs. L. Sterne & Co. Ltd. and
Sir Robert MacAlpine & Co. Ltd.



*The most modern
store in the U.K.*

W. A. TAYLOR LIMITED

Head Office: PITCAIRN ROAD, MITCHAM
SURREY, ENGLAND
Phone MITcham 6161 (5 lines)

Works: CRUSOE ROAD and
SWAINS ROAD, MITCHAM

African Subsidiaries: Overseas Insulations (Pty.) Ltd.,
Johannesburg.

Overseas Insulations (Rhodesia) Ltd.,
Bulawayo, S. Rhodesia.

Photographs by permission of The British Transport Commission
and Messrs. L. Sterne & Co. Ltd.

MODERN REFRIGERATION

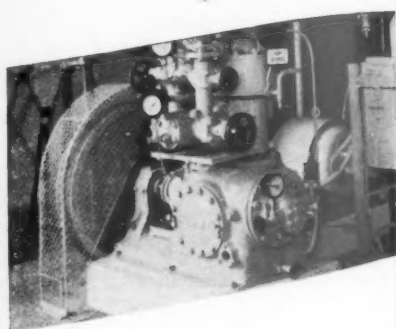
and Air Control News



Incorporating
COLD STORAGE AND PRODUCE
REVIEW
and ICE AND COLD STORAGE
Established 1898

Contents

Editorial	674
Increased Commercial Production	675
News of the Month	676
Picture of the Month	677
Push-Button Ice Cream Plant	678
Polystyrene-Insulated Cold Store	683
New Bread Freezing Plant	684
The Freezing and Cold Storage of Mussels	686
Frigidaire Distributors' New Premises	688
The British Electrical Power Convention	690
A Modern U.S. Cryostat	692
Scottish Cold Storage Topics	696
Refrigeration Controls—7	697
The Danfoss Story	703
Commercial and Industrial Section	708
Institute of Refrigeration Bulletin	717
Shop Refrigeration	719
Compressors of "Freon" Machines	726
Air-Conditioning in America	728
Irradiation Research	731
Patents	732



Editor-in-Chief:
THEODORE A. RAYMOND

Advertisement Manager:
J. A. Hutchinson

MODERN REFRIGERATION overseas

The world-wide circulation of this, the original and oldest Journal of the British Refrigeration Industry, carries "MODERN REFRIGERATION" by postal subscription into the following countries:—

ALGERIA, ARGENTINA, AUSTRALIA, AUSTRIA, BELGIAN CONGO, BELGIUM, BOLIVIA, BRAZIL, BULGARIA, BURMA, CANADA, CEYLON, CHILE, CHINA, COLOMBIA, COSTA RICA, CUBA, CYPRUS, CZECHOSLOVAKIA, DENMARK, ECUADOR, EGYPT, EIRE, FALKLAND ISLANDS, FINLAND, FRANCE, GERMANY, GIBRALTAR, GREECE, HOLLAND, HUNGARY, ICELAND, INDIA, INDONESIA, IRAN, IRAQ, ISRAEL, ITALY, JAPAN, KENYA, MADAGASCAR, MALAYA, MALTA, MEXICO, MOROCCO, NEW ZEALAND, NEWFOUNDLAND, NORWAY, PAKISTAN, PALESTINE, PATAGONIA, PERU, PHILIPPINES, POLAND, PORTUGAL, RHODESIA, ROUMANIA, SPAIN, STRAITS SETTLEMENTS, SWEDEN, SWITZERLAND, SYRIA, THAILAND, TURKEY, UNION OF SOUTH AFRICA, UNITED STATES, URUGUAY, U.S.S.R., VENEZUELA, WEST INDIES.

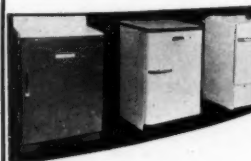
"M.R." now in its 61st year of publication, has built up for its overseas readers special subscription and sales agencies in all the above territories.

★

Price 2s. 6d. net per copy.

By post 3s.

Subscription: £1 15s. per annum.
including postage.



Maclaren House,
131 Great Suffolk Street,
London, S.E.1.

Telephone: HOP 5712
Telegrams:
Buns, Souphone, London

July . 1958

VOLUME 61

NUMBER 724

Editorial

Precooling Vegetables

The Vending Machine Habit

Refrigeration Helps Pattern-making

● In addition to opening up entirely new fields of application, the refrigeration "back-room boy" often puts on an economic basis traditional commercial operations practised wastefully by earlier generations.

● The above is particularly true in the case of produce marketing. For many decades the market gardener has sought to put his leafy commodities on urban markets in as fresh a condition as possible by dousing them in water—in earliest days, by throwing buckets of water over them and later by the use of a hose. These methods were partially effective but it needed the modern system of hydro-cooling to put the matter on a businesslike and efficient basis. Four years ago we had the pleasure of describing a prototype plant produced at Cowley that was designed to remove from freshly picked vegetables their field heat.

● Last month, we had the opportunity to inspect the latest development of this equipment in commercial use on a farm at Marlow. This hydro-cooler, available in various sizes to suit differing requirements, has been placed on the market by Prestcold and there are a number of installations in locations as widely dispersed as the Vale of Evesham, Skegness, South Wales, and on a farm near Bournemouth, while many more are being installed. The produce being hydro-cooled covers a wide range and includes cabbage, lettuce, broccoli, sprouts and watercress. There is now evidence that the discriminating housewife is noticing the difference in hydro-cooled produce and is selecting it to the exclusion of others.

● An illustration of the Marlow installation will be found overleaf. Essentially, it consists of a large tank in which 34°/36° F. water is sprayed over the produce; this water is cooled by ice-making plants which build up a cold-bank. The ice-makers, two in number, comprise a series of flat evaporator plates. The number of crates that

pass through the tank is controlled by the number that is taken out. It is estimated that a 30-lb. crate costs 3d. to "process" in a 450-crates-a-day plant and that cabbages dealt with in this way may make up to 3s. per crate more on the commercial market.

● While on the subject of precooling, it is interesting to record that the D.S.I.R. has produced a new booklet on the handling, precooling, transport and storage of strawberries and raspberries by W. Hugh Smith, B.A., DIP. HORT. (CANTAB.). This leaflet sets out, in simple terms, the measures which can be effectively taken to improve the condition of soft fruit reaching the consumer or the factory; it is well timed.

● The massiveness of Russian programmes and work in fisheries research was commented on recently at the Rome headquarters of the Food and Agriculture Organization (F.A.O.), by Dr. G. L. Kesteven, Chief, biology branch, fisheries division, F.A.O., on his return from Moscow. "The Russians have about 50 groups, employing thousands of people, working on fisheries research," he stated. "The staff of the All Union Institute of Research in Marine Fisheries and Oceanography alone amounts to 500 persons." As the result of this widespread activity, the Russians are "accumulating vast amounts of material. My impression was that this extensive work in fisheries research is well co-ordinated even though it involves many institutions and scientific bodies," said Dr. Kesteven. While in Moscow, where he attended a meeting of the International Advisory Committee on Research in the Natural Sciences Programme of U.N.E.S.C.O., Dr. Kesteven conferred with a number of Russian officials and scientists. One result of his visit is that the Russians have promised to supply F.A.O. with a monthly annotated list of U.S.S.R. fisheries literature. They have also promised to collaborate in the preparation of a manual on institutions, research organizations and scientific bodies engaged in fisheries work in Russia.

● It would seem that the automatic vending of groceries, provisions and dairy produce has come to stay. Months of experiments by the Express Dairy Co. Ltd. in London has confirmed this view. A four-column ever-open shop was installed by the Express Dairy outside their Marchmont Street (Euston) shop and it was stocked with various grocery items ranging in price from 9d. to 2s. They also installed a refrigerated ever-open shop for selling such things as yoghurt, butter, cream, bacon, cheese, eggs and cooking fat. Initially, considerable adjustment of stock was necessary to determine which items and prices were most popular with the coin-in-slot customers. It was

soon found that the goods priced below 2s. sold most quickly and so the items over that price were replaced by lower-priced articles. The director of sales development for Express Dairy Co. (London) Ltd., Mr. T. W. Evans, says that following these readjustments, the experiment has been "extremely successful, providing a most useful, additional, after-hours business which is to be extended to other Express Dairy shops in the near future."

● Another of those successful refrigeration applications now being found on every hand in industry concerns patterns for precision casting. Mercury, solidified by freezing, forms the pattern material in a new process. The process is used for making ceramic moulds for precision castings in magnesium, aluminium alloys, beryllium-copper and heat resisting alloys. It provides greater flexibility than other methods and has made possible the production of small to relatively large complex parts which hitherto could not be made by investment casting. Mercury is poured into a closed steel die and the assembly is lowered into a refrigerated bath of acetone at $-70^{\circ}\text{C}.$, remaining there until the mercury is frozen solid. The die is then opened, and the solid mercury pattern removed. Frozen mercury possesses the property of welding to itself when two pieces are pressed together lightly. This enables accurate internal and external forms to be prepared by making a pattern in several parts and joining them in a jig. When the pattern is finished, it is dipped repeatedly at low temperature in a ceramic slurry to build up

a thin shell mould round it, usually to a thickness of $\frac{1}{16}$ to $\frac{1}{8}$ in. The mould and mercury are then allowed to rise to room temperature, and the mercury, now liquid, runs out. It is then only necessary for the mould to be fired at a high temperature for approximately two hours to make it ready for use.

● Negotiations which have recently been taking place between Unilever N.V. and Vita N.V., the Dutch quick-frozen food business, have been completed and have resulted in the Vita business being acquired by Unilever N.V. The business hitherto carried on by Vita N.V. will be continued on the same basis. Vita N.V. has been engaged in the quick-frozen industry for many years and has a substantial export trade in many countries including the United Kingdom. The company owns factories at Utrecht, Rotterdam and Leiden. The managing director is Mr. J. van der Meer.

● Congratulations to the French Association of Refrigeration which celebrates its 50th Jubilee this year. This anniversary will be suitably marked during the period September 22 to 27 when a full programme of addresses, papers and technical visits will be held in Paris and environs. In the Conservatoire National des Arts et Metiers, a history of the Association will be given by Monsieur Michel Anquez, the secretary-general, from whom full details and forms may be had at 129, Boulevard Saint-Germain, Paris-6. President is Monsieur A. Dulin.

INCREASED FRIGIDAIRE COMMERCIAL PRODUCTION

UNIT sales of Frigidaire commercial refrigeration products for the period June, 1957 to June, 1958 showed an increase over the previous 12 months of 23.7 per cent.

This was announced last month by Mr. A. W. Porter, director and general manager of Frigidaire Division of General Motors Ltd., in a review of the company's five point development programme which had just celebrated its first anniversary.

The programme, originally announced on June 6, 1957, at a meeting at the May Fair Hotel, London, of Frigidaire distributors and representatives of the press, planned expansion under five headings: Production, sales, sales service, training and export.

In reviewing the progress made during the first year, Mr. Porter stated that the 23.7 per cent. sales increase with its accompanying rise in production had contributed to the fact that overall sales of the company's products in all fields reached a record figure in 1957.

To accommodate this increased volume new plant and equipment had been installed in the factory at Stag Lane. This in turn had made it possible to further increase manufacturing efficiency with the result that despite increased

costs, prices of all products had been maintained and in some cases had actually been reduced; including, in January, the whole range of the company's frozen food cabinets. These, together with a series of evaporator coils, had been reduced by an average of 7 per cent.

New commercial products had also been introduced at the rate of one a month through the 12-month period and the production rate of one compressor model alone—the "Meter-Miser" hermetically sealed rotary compressor—had risen from 700 to over 1,000 units a day.

Commenting again on the decision made last year by Frigidaire, Dayton, U.S.A., to cease manufacture of commercial refrigeration equipment, Mr. Porter stated that although the immediate effects of this decision on our own export position had not been expected to become immediately noticeable, exports from the Hendon plant had in fact increased appreciably since June last year.

Exports of low temperature cabinets, for instance, had increased by 20 per cent., condensing units by 8 per cent. and reach-in cabinets by 7 per cent. These increases were expected to be even greater in the coming year following the overseas convention held in London during January which had been attended by representatives from 27 different countries. Orders from these countries, geographically situated as far apart as South America, Africa, Europe and the Far East, were now being placed in considerably increased volume.

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During May 1958 air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £674,655 weighing 1,043 tons, was exported from the United Kingdom. Comparable figures for May 1957 were 1,826 tons, worth £1,141,955.

Exports' Analysis.—Of the 1,043 tons of air-conditioning and refrigerating plant worth £674,655 exported by Great Britain in May 1958—quoted in the preceding paragraph—41 tons went to the Union of South Africa, 82 tons to India, 38 tons to Australia, 34 tons to New Zealand, 23 tons to Canada, 233 tons to "other Commonwealth countries," 115 tons to Eire, 21 tons to Sweden, 76 tons to Western Germany, 43 tons to the Netherlands, 39 tons to Belgium, 11 tons to France, 78 tons to Italy, and 209 tons to "other foreign countries."

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during May, quoted in the first paragraph, commercial refrigerators accounted for 184 tons, worth £108,127, industrial plant and equipment accounted for 236 tons, worth £110,798, parts for all non-automatic power-operated machinery, 365 tons, worth £279,728.

Exports of Small Refrigerators.—During May, 1,512 tons of complete refrigerators (domestic, including complete mechanical units) were sent overseas from Great Britain. These exports were worth £702,296. The 1,512 tons comprised 40 tons to the Union of South Africa, 22 tons to Rhodesia and Nyasaland, 21 tons to India, 145 tons to New Zealand, 712 tons to "other Commonwealth countries." Eleven tons to Sweden, 22 tons to Western Germany, 9 tons to the Netherlands, 83 tons to Belgium, 80 tons to Italy, and 367 tons to "other foreign countries."

Scotland's Largest Ice Cream Depot.—Scotland's largest ice cream supply depot, in London Road, Glasgow, will be opened this month by the Rt. Hon. Thomas Johnston, chairman of the North of Scotland's Hydro-Electric Board. The depot, which has been built for T. Wall & Sons (Ice Cream) Ltd., of Craigmillar, Edinburgh, by Messrs. Muir of Kilmarnock, replaces existing premises in Summerfield Street, Bridgeton, Glasgow. Building

of this larger depot has been made necessary by the increased demand for the firm's ice cream in the Glasgow area. One of 107 ice-cream supply depots maintained by Wall's in principal centres throughout Britain, the new Glasgow premises will serve a population of 2,100,000 and will have a cold store capable of holding 2,450,000 ice creams.



The photograph shows (left) Mr. K. J. R. Cocke, director and deputy general manager, Prestcold Refrigeration Division, and Mr. T. Whittaker, director, British Refrigeration Association, as they alighted from the plane on their return from the recent meetings in Brussels, where with Mr. J. A. Howie they formed the British Refrigeration Association delegation to the European Committee of Manufacturers of Refrigeration Equipment.

PRESTCOLD TO MOVE TO SWANSEA

BY arrangement with the Government a large factory will be built for Pressed Steel Co. Ltd. in Swansea. It will be one of the most modern of its kind in the world and the plant will embody a high degree of automation. This project repeats the precedent established by the company in 1947 when they helped to relieve unemployment by occupying a Government-sponsored factory in the

development area of Linwood, near Glasgow, which is now employing over 2,000 persons.

It is expected that 2,000 persons will be employed at Swansea within 18 months of occupation and that the labour force will increase to about 4,000 over the following four to five years.

It is estimated that the factory will be completed during the spring of 1960. The company will then transfer by stages the whole of its Prestcold refrigeration division which is at present divided between the Cowley and Theale factories.

It is intended that all employees at the two factories now engaged on refrigeration will be employed in the company's expanding motor car body division, except for the key personnel required in Swansea who will be transferred on a voluntary basis.

The company will continue to manufacture

Prestcold refrigeration equipment, and additional domestic appliances will be produced over the next few years bearing the same trade name. The products of this factory will be highly competitive both in the home and export market.

Latest venture of the Lec flying showroom is to run a shuttle service to and from the factory and the Midlands twice a week. A number of distributors are picked up at the aerodrome nearest their theatre of operation, and brought by air to Bognor Regis where they spend a day at the factory as guests of the Lec management, being flown back in the evening. Lec have always believed in the personal touch and consider that a trip of this nature engenders in visitors a far greater interest in Lec products. They also pick up many talking points during their visit which make sales easier later on. Mr. Harry Underwood of C.E.A., Leicester, one of Lec's biggest distributors, said that normally such a trip would involve three days. The Lec aircraft makes it possible in one and with far greater comfort.

PICTURE OF THE MONTH



The subject of hydrocooling—the precooling of produce on the farm—is discussed on page 674 this month. Here is the Prestcold hydrocooler in operation at Marlow. Crates of cabbages are being loaded into the guide lanes.



JULY 1958

PUSH- BUTTON ICE CREAM PLANT



This engine-room control panel is an example of the high degree of automation at Greenford.

NEW GIANT PREMISES AT GREENFORD WITH REFRIGERATION POWER OF OVER 2,000 H.P.

THE claim that the new Bridge Park ice cream factory of J. Lyons & Co. Ltd. at Greenford, Middlesex, is "the best equipped and most advanced" ice cream plant in the world would be hard to contest. For here is a spotlessly-clean building automated to the "n"th degree.

All the manufacturing processes at Bridge Park have been formulated to allow all the raw materials—concentrated milk, sugar, fat, fruit and other flavourings, and water—to be mixed in their proper proportions, treated, frozen, wrapped and packed in one continuous chain of operations. In its truest sense, this is flow production.

The tankers that bring the raw materials to the factory transport these commodities in the liquid state so that they can be easily handled by pump and pipe-line at the reception point. As soon as a tanker arrives the driver makes a connexion from it to the appropriate pipe-line; the operator on the central control panel then sets the necessary switches to have the contents conveyed to the storage vat that is ready to receive it and the sugar or fat or milk is pumped out of the tanker. The method of weighing the contents of the storage vats is ingenious. Each vat is mounted on "load cells." These are instruments which have been specially developed from the strain gauges used to test stresses in aircraft. As the liquid enters the tank the increasing weight causes a very slight distortion in a metal bar. The distortion is measured electrically and the result is flashed to the control panel to show the level of the liquid on a diagram of the vat. The panel also translates the weight of liquid into figures and these can be read off the dials or recorded automatically by an electric typewriter.

Most of the manufacturing operations follow the established pattern and need not be described here.

The actual freezing of the mixture, however, is most important as it takes only a few seconds and this quick freezing is one of the secrets of the superlative quality of the product.

Various types of ice cream are made at Bridge Park, including "Family Brick," "Zippy" (the wafer portion), and "Pola Maid" (the cone and restaurant portion). The general principles of freezing are the same in each case but there are considerable differences in the processes that follow. The most complicated and, perhaps, the most interesting machinery of all is to be found in the "Zippy" and "Family Brick" sections of the factory.

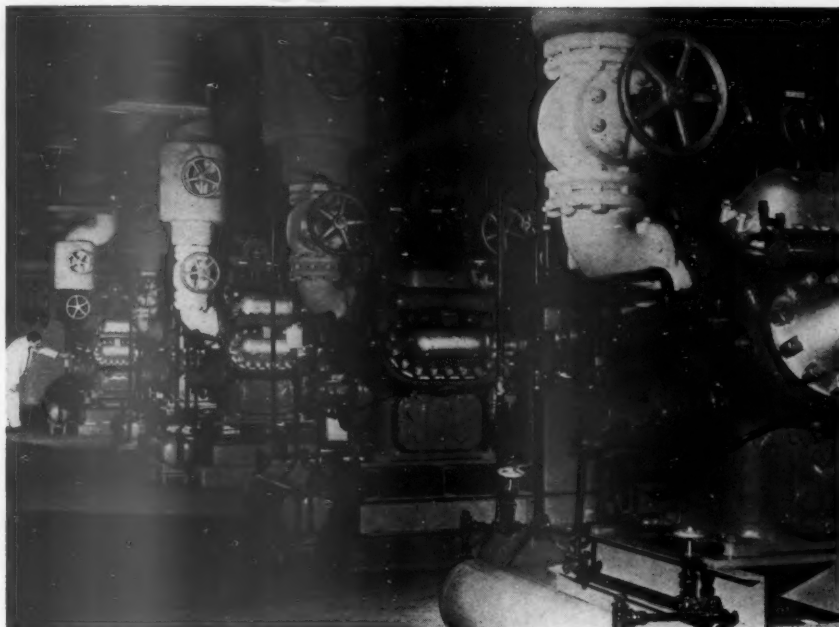
While the "brain" of this automatic factory is the control panel, its heart lies in the ammonia plant and in the engine room from which all the services are supplied and controlled, and here again everything is as fully automatic as possible.

By far the largest single piece of mechanical engineering work in building and equipping the factory was the manufacture and installation of the refrigerating plant. This work was carried out by York Shipley Ltd., as main contractors.

The machinery and equipment at Bridge Park form one of the biggest refrigerating plants devoted entirely to the production and storage of ice cream that this company has ever been called upon to manufacture and install. It includes some of the largest single units of equipment ever built by the company; for instance, the air-cooling coils in nos. 21 and 22 cold stores, weighing over 6 tons each, and the shell-and-tube condensers installed in the main engine room, weighing over 10 tons each.

The refrigeration plant installed in the main engine room

Refrigeration machine
hall showing V/W
ammonia compressors.

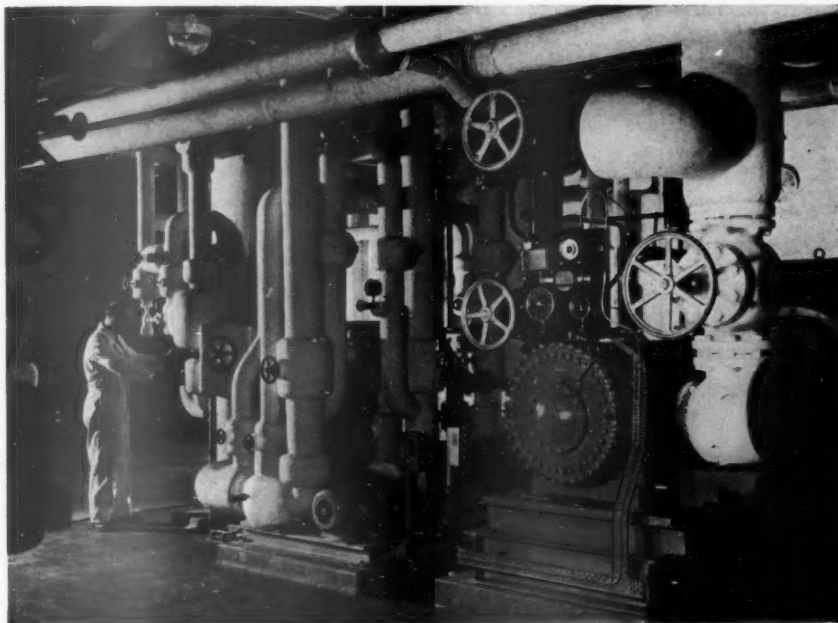


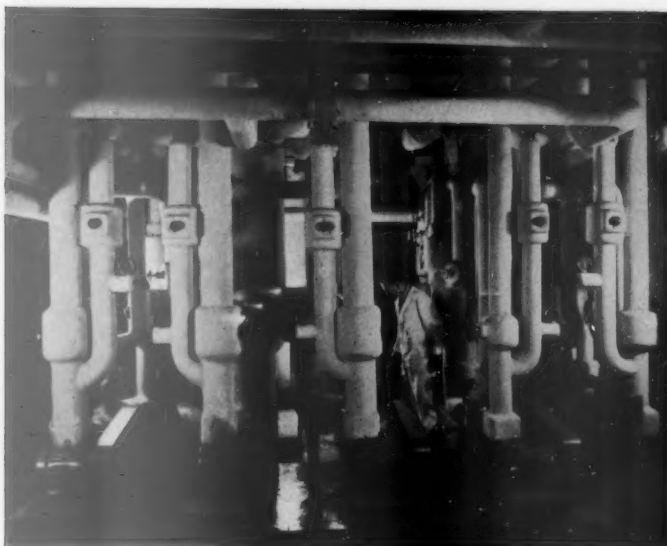
serves all the refrigeration needs on the process floor, including the refrigerating equipment for the "Zippy" and "Family Brick" hardening tunnels, the "Pola Maid" hardening cabinets and all the freezers. It also provides the chilled water supply for the continuous mixing plants,

refrigeration for the holding vats for ice cream mix and for the factory cold stores.

The impressive main engine room houses a total of 12 ammonia compressors comprising five 6½ in. by 5 in. V/W compressors, five 15 in. by 10 in. vertical single-acting

One of the two
rotary booster
compressors.

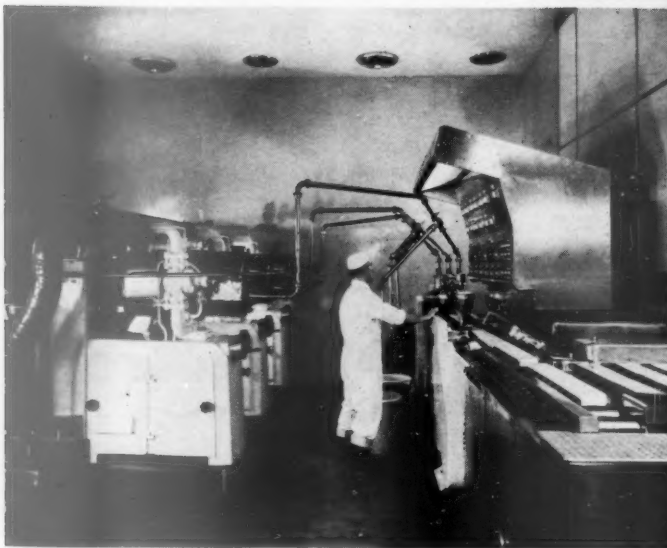




Above: The complex network of pipes which forms part of the low-pressure side of the refrigeration plant with the surge drums in background.

Right: A section of one of the hardening tunnels.

Below: The sleeve-way machine with freezers on left.



compressors and two rotary booster compressors, with a total connected horsepower of over 2,000.

These machines are used to operate a multi-temperature two-stage system as well as a conventional single-stage system.

Associated with these compressors are two 45 in. by 14 ft. shell-and-tube condensers, two 36 in. by 16 ft. ammonia liquid receivers and ammonia liquid recirculating systems with pumps to serve the various evaporators throughout the factory. A further six compressors of the above types are to be added at a

later stage in the factory's development. An intricate network of ammonia pipe-lines connects the engine room equipment with that on the production floor and in the cold stores, with a total length of a little over three miles and the whole installation utilizes no less than 15 tons of ammonia refrigerant.

Due to its lowering effect on the overall plant efficiency, special consideration has been given to the problem of oil carry-over and separation. The plant has been equipped with water-cooled shell-and-tube oil separators in the main discharge lines while the individual machines have mechanical type oil separators and all the evaporator surge drums are equipped with oil blow-down facilities.

The oil blow-down system is piped back to a holding vessel where the ammonia and oil are allowed to separate. The oil is drained off to a rectifier whence it is eventually purged from the plant, while the remaining ammonia is returned to the main system.

In addition to the main engine room equipment, this company has installed the refrigerating plant for nos. 31 and 32 despatch cold stores which occupy a separate building from the main factory. This comprises a complete two-stage refrigerating installation operating on "Arcton-6" refrigerant and includes three 16-cylinder 3½ in. by 3 in. V/W compressors, shell-and-tube condensers with water coolers. Air blast coolers equipped with water defrosting equipment are installed in the cold stores.

York Shipley were called into consultation with Lyons Maid engineers at a very early stage in the planning of Bridge Park so that all this work should go forward as smoothly and quickly as possible and they kept a resident engineer on the site to settle problems as they arose; but there was one difficulty that could not be overcome by any amount of advance planning and consultation—the weather.

The first work to be put in hand was the installation of the refrigerating plant for the despatch cold stores. Work started at the beginning of 1956 during a period of severe wintry conditions. In order to allow the equipment for these cold stores to be delivered, temporary roadways had to be laid but under the weight of equipment they had to bear, before long these became little more than tracks leading to what, during a spell of heavy rain, was almost literally an island site!

Installation of the refrigerating plant was commenced as soon as the engine room area had been roofed over and proceeded simultaneously with the erection of the rest of the building. Similarly, work on the main engine room was commenced as soon as the roof had been erected over that portion of the factory area, in October 1956. Although the winter of 1956-7 was a mild one, there were long periods of wet weather and for a long time the very heavy items, including compressors weighing 4 tons, had to be coaxed to their destination through seas of mud.

York Shipley did not have the building to themselves during the work of installing the main engine room equipment and the pipe-lines to the refrigerating plant on the production floor. Inevitably at this stage a number of other contractors were at work as well, but because the whole construction schedule had been most carefully worked out in advance, the numerous problems that arose on the site were quickly solved.

Every week, architects' meetings were held on the site enabling any difficulties that might have arisen to be ironed out and all contractors were thus able to work together in a spirit of close harmony and co-operation at all levels.

Apart from its size, one of the outstanding features of the ammonia refrigerating plant which serves the factory and the factory cold stores is the exceptionally high standard of safety precautions that have been incorporated.

This was brought about by the closest co-operation between York Shipley and Lyons Maid engineering staffs. All instrumentation and safety alarm indications are incorporated in the engine room control panel and, as has been mentioned earlier in this brochure, the operating engineer in charge can see at a glance if any fault develops, the nature of the fault and its exact location.

One example of this is the inclusion of magnetic float switches which are installed in all low-temperature vessels containing liquid ammonia. These switches give an indication on the engine room control panel of the ammonia level in the liquid receivers.

In order to guard against the compressors drawing in

liquid refrigerant, a series of suction traps is installed in each of the main suction lines between the compressors and the refrigerating equipment throughout the factory.

A further safety measure is the provision of shut-off valves for isolating major items of ammonia plant in the event of a refrigerant leak, or mechanical breakdown. These valves are instantly operable by remote control from points inside and outside the engine room.

To ensure that all operating staff were completely familiar with the control of the plant and the operation of the many safety measures incorporated, the refrigeration contractors, in co-operation with Lyons Maid engineers arranged a series of illustrated lectures for the operating engineers before officially handing over the plant.

During the whole period of initial planning and design, installation and putting into service of the refrigerating plant, York Shipley engineers were afforded the utmost collaboration and assistance of the Lyons Maid engineering staff and were privileged to attend the meetings as refrigeration consultants. The result has been an installation that is outstanding in respect of size, technical excellence and safety, and a credit to all concerned.

The refrigeration plant in the third of the despatch cold stores was supplied and installed by L. Sterne & Co. Ltd. The equipment for this cold store, like that in the other despatch stores, is completely self-contained, using "Arcton-6" as the refrigerant. In this case, however, two-stage compressors were specified instead of the single-stage compressors used for the two other stores. These two-stage compressors, which are part of Sterne & Company's standard range of refrigerating machinery, can be used either with "Arcton-6" or with ammonia.

One of the keys to the flow production of ice cream is the method of pasteurizing the liquid mix by the high-temperature/short-time (or H.T.S.T.) process. The H.T.S.T. pasteurizing plant at Bridge Park, together with a great deal of the other equipment on the production floor, was supplied by the A.P.V. Company Ltd. Bridge Park is the first ice cream factory in Britain to be designed for "in place cleaning." The pipe-lines and fittings, again in stainless steel, were specially developed for this purpose and were also supplied by the A.P.V. Company Ltd., who are one of the world's largest manufacturers of stainless steel pipe fittings and other equipment for use in the dairy industry.

The continuous freezers chosen to operate in conjunction with the rest of the automatic processing plant at Bridge Park were supplied by Clarke-Built Limited. The frozen mix is constantly removed from the burnished internal surfaces of the barrel by two specially designed and highly sharpened blades attached to the mutator shaft which revolves at high speed.

The insulation of the various vessels of the refrigeration plant and of the refrigeration pipe-lines, to the freezers and hardening tunnels was carried out by the Onazote Insulation Company Ltd. The same company also installed the insulation required for all the chilled water lines throughout the factory.

Some thousands of feet of piping, ranging from 1½ in. to 10 in. in bore, were given a covering of Onazote which was manufactured in half sections 3 ft. long, so designed that two sections fitted exactly round a pipe of the size for which they were intended. In order to increase the degree of insulation still further, a second layer of Onazote was placed in position over the first.

The central control panel gives, in figures that can be read at a glance, a minute-by-minute indication of the stocks of raw materials and mix in the various storage tanks and holding vats, and continuous information on temperatures. The complex instrumentation for the stock control

sections of the panel was carried out by Elliott Brothers (London) Limited.

The panel at Bridge Park is the first of its kind installed in any food processing plant in the United Kingdom. It incorporates the most advanced methods of giving vital plant information continuously in digital form as well as showing liquid levels on the mimic diagrams.

The instrumentation designed and supplied by Elliott Brothers gives a continuous survey of the vat weights and temperatures of the sugar syrup, fat, milk, strawberry puree, strawberry mix and vanilla mix. It has been so arranged that it can monitor at one-minute intervals 16 different weights and 16 temperatures.

The weight measurements range from a minimum of zero to 800 lb., reading in increments of 1 lb., to a maximum of 15 tons, reading in 15-lb. increments. Temperatures are measured over a range from -32°F . to $+140^{\circ}\text{F}$. in steps of one degree.

The measurement of vat weights and temperatures is entirely electrical, the individual readings of weights and temperatures being shown in figures on circular illuminated display units arranged in columns under the appropriate mimic diagram. In the event of weight or temperature approaching the limit of safety, a visual preset alarm warning comes into operation underneath the mimic representation of the vat concerned.

The engine room control panel was also manufactured and installed by Elliott Brothers Limited. The whole of this panel is fitted in anti-vibration mountings because of its nearness to the compressors. The panel consists of a vertical section containing indicating and recording instruments and a horizontal section containing the central control switching together with indicating lamps and alarms.

On the left-hand wing of the panel are the instruments indicating and recording air pressure, relative humidity, water flow to the chlorinating plant and water level of the main supply tanks.

Ammonia and steam pressure, water temperatures, steam flow and the levels in the liquid ammonia receivers are recorded on the centre section of the panel. The third wing of the panel has instruments for indicating and recording temperatures. The equipment here is so flexible that 61 different temperature-sensing points can be linked up by means of switches on to any combination of indicators and recorders.

A particularly interesting feature of the panel is that pressures of water, steam and liquid ammonia are relayed to the panel pneumatically by transmitters situated close to the points at which the required measurements are being taken. This system makes complicated pipework unnecessary inside the panel and isolates it from the factory flow lines.

The difficult problem of making continuous level measurement of liquid ammonia at high pressure has been solved by the use of Elliott's standard displacement type level transmitters. These signal the levels to pneumatic receivers in the panel, isolate the panel from the ammonia system, and avoid the use of long runs of small-bore ammonia pipe.

The temperature-measuring equipment receives signals from platinum-wound resistance thermometers situated in various positions throughout the factory. This method allows temperatures to be recorded graphically from the ventilating ducts feeding the production floor, the factory cold stores, the chilled water supply lines and various other parts of the factory equipment.

For heating the production floor, and various other parts of the factory, hot water is led into special copper coils covered with fins of virtually pure aluminium. These coils, which were made to the specifications of Lyons Maid engineers by United Air Coil Ltd., work in conjunction with fans which drive the heated air wherever it is needed and other fans which extract vitiated air from the factory. The coils have been designed to serve a dual purpose. By passing

chilled water from the refrigerating system through them instead of hot water, they can be used for cooling the air if, at any time, complete air-conditioning of the factory is required. Eight coils in all were supplied and in each of them there are 550 ft. of copper tubing with 1,900 ft. of aluminium strip for the fins.

The factory has two separate cold-storage sections each of which incorporates the latest methods of temperature control, air circulation and defrosting, and of rapid stacking and movement of the packages of ice cream.

The first of these sections, the factory cold store, is on the ground floor of the main building. The ice cream arrives from the production floor by a conveyor which distributes the cartons and parcels along a packing line. Here they are put into pallets and these are lifted by fork lift trucks and stacked two high.

In the factory cold store the ice cream gets its final hardening; cold air, kept in movement by a forced draught circulating system, brings its temperature down to minus 20°F . or 52° of frost. After two days in the factory cold store, the pallets of ice cream are taken by fork lift truck to the despatch cold store which is in a separate building from the main factory.

The despatch cold store is in many ways a remarkable building. It was put up before work commenced on the construction of the factory itself, and, in order to cut down building time, was built from the inside outwards. Instead of putting up the outer walls first and then insulating them, the insulation was planned and prefabricated in sections and put into position and then the outer shell was built around it.

The refrigeration system in this store is different from that in the factory cold store. Whereas the temperature in the latter is maintained by the factory's main refrigeration plant, the despatch cold store has its own independent system which works completely automatically and needs no engineer in attendance.

The despatch cold store was made independent of the main factory plant to avoid the need for special attention outside normal working hours and to allow the factory refrigeration plant to be shut down at any time for maintenance or overhaul without the temperature in the despatch store being affected.

Each cold store has its own independent emergency lighting system as well as an alarm system so that anyone accidentally shut in can summon immediate help. The despatch store also has an escape hatch. At the entrance to each store there is an air lock which prevents warm air entering from the outside; the air lock doors are made of rubber and are so designed that fork lift trucks entering or leaving with their loads can drive straight up to the doors, push them open and go through. When a truck has passed through, the doors close behind it.

The insulation of cold stores to prevent the entry of heat through the walls, floors and ceilings calls for a high degree of technical knowledge and very skilled craftsmanship. At Bridge Park the insulation of the factory cold stores in which all ice cream is held until passed for distribution, was carried out by C. Hemmings & Co. Ltd. Their experts worked in close consultation with Lyons Maid engineers who have themselves sponsored a considerable amount of pioneer work in this field.

While the main factory was still in the planning stage it was decided to commence work on the despatch cold stores, as stated. Work started towards the end of September 1955 and, because storage space would be needed for large stocks of Lyons Maid ice cream in the spring, the target date for completion was the beginning of the following April. In order to have the stores ready in time, revolutionary methods of design and building were adopted.

Under the planning regulations in force, only brick-walled

(continued on page 713)

NEW COLD STORE WITH POLYSTYRENE INSULATION

A new cold store and blast freezer at the Worsted factory of Westwick Frosted Products has just completed 12 months' satisfactory service. The plant is of particular interest because "Styrocell" expanded polystyrene, rather than one of the traditional materials, is used for the cold store insulation.



Exterior of cold store showing vapour seal and aluminium paint finish. At right, suction and sub-cooled liquid lines can be seen.

Interior of cold store showing dunnage battens supporting open webbed ceiling joists, super-freezer door, etc.



AS a result of the good fruit and vegetable season experienced by Westwick Products in 1956, it was decided to increase the cold storage capacity and blast freezing facilities at their Worsted factory, in time for the 1957 season.

Specifications were drawn up by J. & E. Hall Limited and the insulation work was begun by Smiths Insulations Limited early in 1957. The entire store and blast freezer were ready for use by the end of May of that year.

It was decided that the new cold store and blast freezer should be insulated with "Styrocell" ex-

panded polystyrene. Expanded polystyrene was chosen, not only because this material does not become ice logged but also because of its desirable insulating properties. The reduction in the thickness of insulation required allowed increased cubic capacity within the store, while maintaining the same exterior dimensions. The normal thickness of traditional insulation would have been 8 in. but only 6 in. of "Styrocell" were necessary. Allowing for the reduced insulation thickness and the lower weight-for-weight cost of "Styrocell," the overall cost of insulation material was approximately 56 per cent. lower than if traditional material had been used, claim the suppliers.

The store is operated as a blast freezer, working at a temperature of minus 25° F. and also as a cold store at minus 10° F. Its cubic capacity is approximately 8,150 c.ft. A frost heave mat is incorporated in the floor construction over which lies 2 in. of concrete, a bitumen vapour seal, the "Styrocell" insulation and a further 3 in. of reinforced granolithic concrete, finished off with $\frac{3}{8}$ in. of Betanac. The walls consist of a system of wooden battens which support open web ceiling

joists, the wall and ceiling insulation is built on to the exterior of this basic edifice. A large super-freezer door with heater is fitted.

There are two ammonia compound compressors with flash-type inter-coolers, one rated 24.2 tons at minus 25° F. and the other 5.5 tons at minus 20° F. These compressors are connected to two gilled tube evaporators which have six 24-in.-diameter axial flow fans. The evaporators are connected to the compressors via the suction separator and the weight of each evaporator is 4½ tons, without casing, fans or fittings. In order to support this weight the floor insulation has been made of a density of 2 lb. per c.ft. at which density the compressive strength of "Styrocell" is approximately the same as that of traditional rigid materials. The wall and ceiling insulation are of 1½ lb. per c.ft. density.

Care has been taken throughout the whole construction to ensure that the entire room is vapour-proof. This has been achieved with a bitumen vapour seal which was trowelled on to the gypsum cement forming the outside of the insulation, thus producing a complete, unbroken envelope.

Bread and Confectionery Freezing

New Installation at Liverpool

A NEW deep freeze plant for bread and flour confectionery has been recently opened at their Liverpool bakery by Sayers (Confectioners) Ltd. of Lorenzo Drive, Liverpool. This plant, which is believed to be the largest of its type in the country, incorporates in its design the most modern refrigeration techniques as applied to the deep freezing of bread and flour confectionery. It has been built by the Lightfoot Refrigeration Company Limited of Wembley, Middlesex after some months of consultation and experimentation by that company working in conjunction with Messrs. Sayers.

Unlike previous plants constructed for the deep freezing and storing of bread and confectionery, this new installation has no separate freezing chamber. The plant consists of a cold store and a machinery house, situated near the store, with an evaporator room sited between them. The structure has been erected under the yard canopy of the bakery and is separate from the main building. The gable wall of the building was pierced for the width of the chamber, the upper section of the wall being supported on a compounded R.S.J. beam. Half the chamber was thus built in the main building and the remainder erected under the yard roof.

The Cold Room or Store

The cold room is a brick structure having a roof of prefabricated concrete sections. The walls, ceiling and floor are insulated with 8 in. slab cork, walls and ceiling

being finished internally with Portland cement. In order to leave the finished surface of the floor level with the floor outside the cold room, ground was excavated to accommodate the oversite and insulation.

This arrangement allows the goods to be packed in standard wooden delivery trays in the trolleys in the bakery, moved into the cold store, taken out of the store to a thawing chamber and subsequently to the loading bank for delivery, without any handling additional to the initial loading. The loaded trolleys are used as racking in the store.

An anti-frost heave heater mat, designed to maintain the lower course of insulation at slightly above 32° F., is installed under the cold room floor and low voltage heater gaskets are fitted to the main doors.

The internal dimensions of the cold store give a refrigerated space of approximately 10,500 c.ft. which accommodates 200 trolleys. Each trolley takes 30 wooden trays and is 3 ft. long by 2 ft. wide and 6 ft. 10 in. high. One tray will take up to 8 lb. of large goods or average 2lb. of small goods.

The estimated full capacity of the cold store is 10,000 lb. of goods per 12 hours. Produce enters the store at approximately 70° F. and within three to four hours is reduced to a temperature of -10° F. It is stored until required at a holding temperature of between 0° F. and -10° F.

Freezing of the produce is achieved by air circulation through galvanized sheet steel trunking. This has manually

operated control dampers making it possible to secure even cooling in all parts of the room. Air is drawn from the room via ports situated at floor level, passes through the evaporator chamber where it is cooled and redistributed inside the storage space. To avoid loss of cooled air when the main doors of the cold store are opened, and to do away with the need for an air lock, the main doors are fitted with "Miniveil" air blowers which form a curtain of air across the aperture when the doors are opened to permit the admission or egress of the loaded trolleys. This is a particularly interesting feature of the plant since it represents a departure from normal practice and ensures that the even temperature of the refrigerated space is maintained.

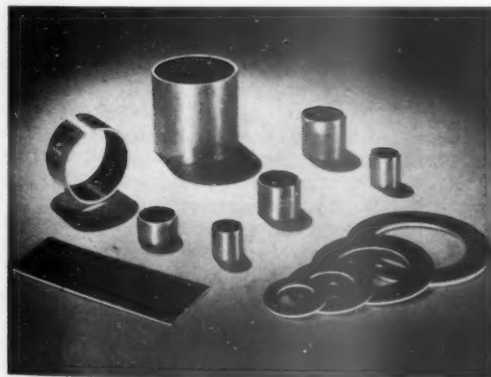
Refrigeration Machinery

The refrigeration machinery consists of two Lightfoot four cylinder, no. 9, "V" compressors, water cooled condensers, and two Lightfoot floor mounted unit coolers. The compressors and condensers, together with ancillary equipment and controls, are compactly arranged in the machinery house. The evaporators, which are housed in a separate room, are of the steel finned galvanized coil type and are equipped with four 24 in. circulating fans. The refrigerant used is "Arcton-6."

Build-up of frost on the evaporator coils is prevented by an automatic defrosting system controlled by a preset time clock. The defrosting medium—ethylene glycol—is stored in a tank placed below the floor of the machinery room, its temperature being thermostatically maintained by an immersion heater.

NEW BUILDING MATERIALS

The Glacier Metal Co. Ltd., of Alperston, Wembley, Middlesex, have announced the introduction of three new "dry" bearing materials: DU, comprising thin steel strip with a porous bronze coating impregnated with a mixture of a fluoro-carbon plastic (P.T.F.E.) and lead; DQ, a fluoro-carbon (P.T.F.E.) strengthened with special fillers and supplied in bars and tubes; DM, a process for



applying an adherent layer about 0.0015 in./0.0025 in. thick of a combination of fluoro-carbon and molybdenum disulphide to the bearing surfaces of customers' parts sent to Glacier for treatment.

A useful addition to the bookshelf is the 1958/9 edition of the Ice Cream Industry Year Book, firmly established as a

JULY 1958

Consumption of condenser cooling water is kept to a minimum by recirculation through a large tower sited on the roof of the cold store to save space.

The main instrument panel is placed on the chamber outside wall and has two dial thermometers showing the chamber temperature. An additional dial thermometer indicates the temperature below the floor insulation. Incorporated into the controls is an alarm system which gives audible warning should the temperature of the cold store rise, for any reason above a fixed minimum (+5° F. approx.).

Like the main doors of the store, the evaporator room door is fitted with a low voltage heater gasket to ensure easy access.

Basically this refrigeration plant is two separate and complete units. During the working day both compressors are in operation to cope with the deep freezing of the produce. At night, only one set is kept running to keep the cold store temperature down to requirements.

Suppliers

Refrigeration plant—The Lightfoot Refrigeration Co. Ltd. Insulation of cold store, evaporator room, suction lines and heat exchangers.—"J.D." Insulating Co. Ltd.

Motors—Crompton Parkinson Ltd.

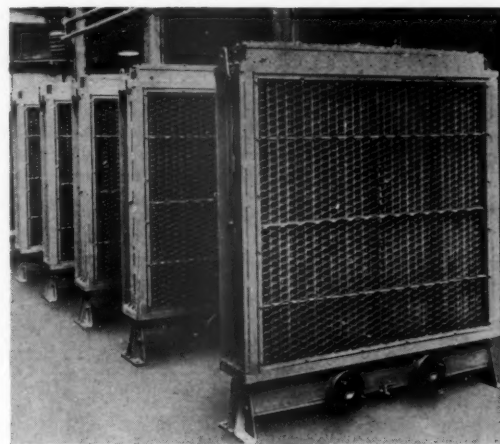
Starters—Edward Holmes & Co. (1931) Ltd.

Fans—Woods of Colchester Ltd.

Water pumps—Worthington-Simpson Ltd.

Water recirculating tower—Heenan & Froude Ltd.

valuable guide for the ice cream and frozen confectionery manufacturer and retailer. Started in 1951 this book, while retaining many of the popular sections of former years, now includes several new features, such as a controversial article reviewing the past year and forecasting trends for the future. There is a new pictorial article on ice cream sundaes, a feature which achieved widespread popularity when it was reintroduced last year. The editorial pages also include authoritative articles on such important matters as the law relating to ice cream, ingredients used in manufacture, and other subjects of topical and technical interest.



Heenan all-metal construction coolers of the type to be used in the Priest Rapids hydro-electric scheme.

The Freezing and Cold Storage of Mussels

By A. BANKS and C. T. HOUSE

*Torry Research Station, Aberdeen, Food Investigation
Organization, Department of Scientific and Industrial
Research*

SATISFACTORY exploitation of the abundant supplies of mussels known to exist around the coasts of Britain is hindered by a number of factors, not the least important of which is the seasonal variation in quality and supply. Mussels are at their best in the autumn and winter months and are normally only harvested then. Experience with fish generally, and with shell-fish in particular, suggests that the proper application of freezing and cold storage might help to solve this problem. Moreover, with the growth in popularity of frozen "prepared" or "semi-prepared" foodstuffs, it might be expected that the average consumer would prefer frozen cooked mussel meats to live mussels in the shell, because of the troublesome procedure required to cook and prepare the latter for the table.

Because of difficulties experienced in the marketing of live mussels, we were approached by the Ministry of Agriculture, Fisheries and Food, with a request for tests on the freezing and cold storage properties of mussels, particularly as reports of commercial trials had been received which indicated that the texture of cooked mussel meats was seriously affected by freezing and cold storage.

Our experiments have shown, however, that by choosing the right conditions of cooking, freezing and cold storage, frozen mussel meats can be kept in a virtually unchanged condition for as long as 8 to 9 months.

Experimental

Raw Material

The mussels used in these experiments were supplied by the Ministry of Agriculture, Fisheries and Food's Experimental Station at Conway, N. Wales. Three lots were tested:—

Lot 1 comprised mussels harvested during the middle of April, 1956. These mussels were not cleansed. Lot 2 comprised cleansed mussels¹ harvested during early February, 1957 and lot 3,

cleansed mussels harvested about the middle of the following month. The mussels were sent to Aberdeen from Conway in wet sacks by passenger train and arrived in a good live condition. They were all heavily encrusted with barnacles.

Cooking

Because of the low content of edible material in live mussels in the shell, it was decided at the outset that it would be necessary for economic reasons to freeze only the edible portion and that it would be necessary to cook the mussels so as to facilitate separation of the meats. Other workers have claimed that overcooked mussels are tough when canned or pickled but the conditions required to produce a satisfactory article are not properly defined. It is clear from the literature, however, that overcooking should be avoided; in addition to its effect on texture it will cause excessive shrinkage of the meats.

Some of the mussels were cooked in a retort for five minutes with steam at 5 lb. per sq. in., the retort first of all being "exhausted" in the usual way for about three minutes. Some of the mussels were then cooled quickly by spraying them with tap water and others were allowed to cool in air. Further samples of mussels were brought to the boil in fresh tap water and in 2.5 per cent salt solution and then boiled for two minutes. When cool enough, the meats were separated from the shells, particular care being taken to remove the byssus thread or "beard" which is firmly attached to the meats at the centre.

All the mussels were encrusted with barnacles, to the extent of 20 to 22 per cent. The yield of meats was 7.7 per cent. (9.7 per cent. of mussels freed from barnacles) in the case of the mussels harvested in April, 1956, quite a number of which were spent, and 11.8 per cent. (15.8 per cent. of mussels freed from barnacles) in the case of mussels harvested in February, 1957.

Packaging and Freezing

The mussel meats, particularly those taken from the uncleansed mussels, were contaminated with sand and in all cases the meats were rinsed three times with water or 2.5 per cent. salt solution to remove as much of this sand as possible before they were packaged and frozen. Some of the mussels were frozen in waxed cartons measuring 9 in. \times 3½ in. \times 1 in. holding about 12 oz.; some in blocks in metal trays measuring 7 in. \times 6 in. \times 1 in. weighing about 1 lb. and others in small tubs holding about 3 oz. which were 2½ in. tall with a diameter of 2 in. at the bottom and one of 2½ in. at the top. All the packages were frozen in an air blast (air at -20° F. moving at about 1,000 ft. per minute); the thin packages were frozen to -8° F. in approximately 50 minutes and the tubs in about 80 minutes. The blocks of frozen mussels were glazed and then wrapped in grease-proof paper and aluminium foil. The mussels frozen in cartons and tubs were not glazed and were cold stored without wrappers.

Quality in Cold Store

In all cases the mussels were submitted to a small panel of 6 to 7 persons for estimation of flavour and texture after various periods of cold storage at -7° and -20° F. In addition the mussels were subjected to simple treatment in order to test the effect of freezing etc. on commercial handling.

A number of tests were made of the effect of different procedures prior to freezing (cooking in different ways, rinsing in water, weak salt solution etc.) on the texture of the mussels, some being made a few days after freezing and others after periods of cold storage extending to 9 months.

By and large, the methods of cooking and of treatment of the separated meats prior to freezing had little adverse effect on the texture of the thawed mussels. When examined immediately after freezing, it was not possible to detect any material difference between the various experimental products and fresh unfrozen meats as regards texture on eating and suitability for being kept in water or weak salt solution for 24 hours and for pickling in vinegar in the usual way. As far as could be judged, all the products retained a normal texture during cold storage at -20° F.; there were indications of a slightly tougher texture on eating in the meats cold stored at -7° F., particularly after three months' storage. Mussels cooked in weak salt solution or cooked in steam or water and then rinsed in salt solution seemed to be a little firmer when frozen than those that had not come in contact with salt. However, slight "off" flavours developed in the former after long storage and the untreated samples were thus preferred. Although differences attributable

to method of cooking were small, there was in general a slight preference for the meats that had been cooked in steam and cooled quickly by spraying with tap water. Boiled mussels, however, gave perfectly satisfactory products.

Particular note was taken of the flavour of the cold stored mussels. For the most part, there was little to choose between the mussels stored at the two temperatures for periods of less than three months. Thereafter there was a preference for the mussels stored at -20° F. because of the development of "off" flavours in the mussels stored at the higher temperature. After 8 to 9 months' storage at -20° F. the mussel meats had a very good flavour, very little different from that of freshly cooked meats; only a slight loss of initial sweetness was detectable.

It was observed that the flavour of the frozen mussels was improved considerably by thawing the frozen meats in 2½ per cent. salt solution or by soaking the thawed meats for a short time in a similar solution. In both cases the salt acted as a condiment. As already mentioned, however, treatment with salt before freezing, either during cooking or rinsing to remove sand, accelerated the development of "off" flavours in the frozen meats during subsequent cold storage.

It was noted throughout that the thawed mussels were always duller than fresh. This feature is characteristic of all frozen fish and a satisfactory way of overcoming this defect has not yet been discovered.

Conclusions

As with all classes of fish including shell-fish, there are no technical difficulties in preserving cooked mussel meats for long periods by freezing and cold storage. Freezing the live mussels in the shell has distinct drawbacks, chiefly economic, and it is necessary to cook the mussels first to facilitate removal of the meats. Just sufficient cooking to open the shells, either in water or steam at 5 lb. per sq. in., gave satisfactory results, though steaming, which might be more suitable for commercial operation, gave a slightly better product than boiling. Cooling the cooked mussels quickly, e.g. by spraying them with tap water, gave an improved product. It is reported that cooling in this way helps to "set" the cooked meats quickly and thus reduces the risk of damage during subsequent handling².

The yield of edible product was quite small and appeared to depend upon the degree of encrustation with barnacles and the biological condition of the mussels. Barnacles accounted for some 20 per cent. of the weight of the live mussels and the yield of meats from mussels harvested in February

was 11.8 per cent. as compared with a yield of 7.7 per cent. from mussels harvested in April. These figures are low, because of the fact that the mussels were harvested late in the season. Figures as high as 16 to 20 per cent. have been reported for mussels harvested during the autumn².

It is necessary to rinse the cooked meats two or three times in water in order to free them as far as possible from sand. Even so, some sand may be still left on the mussel meats, particularly in meats from uncleansed mussels. Experience will show if a simple form of cleansing would be desirable for such mussels; spraying the live mussels with tap water to remove external mud and sand would appear to be an essential minimum requirement.

Being small, mussel meats are easy to pack for quick-freezing by any of the accepted processes. The blocks of frozen fish should be glazed and storage at -20°F . was observed to provide excellent products over a period of eight to nine months. The thawed meats had a perfectly fresh flavour and texture and could be treated in exactly the same way as the fresh. Storage at -7°F . was limited to three months.

The work described in this paper was carried out as part of the programme of the Food Investigation Organization of the Department of Scientific and Industrial Research.

(Crown Copyright Reserved.)

REFERENCES

- ¹REYNOLDS, N., Ministry of Agriculture, Fisheries and Food
Fishery Investigations Series II, Vol. XX, No. 8.
²REYNOLDS, N., Private Communication.



New premises of R. Alger & Sons Ltd., Newfoundland Road, Bristol, officially opened in the spring.

NEW FRIGIDAIRE PREMISES

Canterbury

THE first impression the 1958 visitor gets of Canterbury is of a cake neatly cut in half: rich fruit on one side, iced marzipan on the other. It is an impression that grows as one walks—always it seems under the shadow of the Cathedral—through architecture that changes suddenly along a neat dividing line from 15th to 20th century. This impression has been created by the large new developments that for the last five years or so have been taking place in the west sector of the town, large areas of which were laid waste during the wartime bombing. Here, despite its proximity, no compromise with the past has been allowed to intrude and rubbing shoulders with the wattle and timber beams bright contemporary buildings in concrete and glass are rising in increasing numbers from the bombed sites. One of the most recent of these additions to modern

Canterbury is the newly completed branch of D. P. Toomey & Co. Ltd., which, situated in Oaten Hill, was officially opened on May 6. Besides the imposing façade and showroom the new building houses administrative and service offices, a spacious warehouse with additional facilities for service parts and service repairs and a parking and loading space situated at the rear of the premises. Apart from branch manager, W. Saunders, and the office staff, two salesmen and five service men will operate direct from here, serving an area that takes in most of Kent including the main coastal towns from Chatham to Dover. Two further service men, based at Ramsgate and Folkestone, will also be attached to the Canterbury branch. It was in the new showroom which boasts one of the largest plate glass windows in Canterbury that the official opening took place. Dealers and commercial users from places as far apart as Margate, Maidstone and Deal attended the reception given by Mr. and Mrs. D. P. Toomey and were then, during

the course of the evening, taken over the new premises and introduced to the large range of Frigidaire commercial and household products on display in the showroom.

Shrewsbury

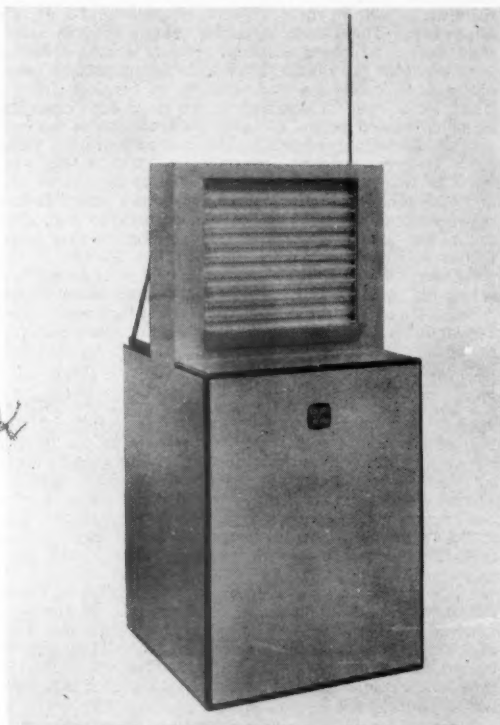
A new branch of Walkers (Liverpool) Ltd. was opened in Shrewsbury on March 26. These premises which are modern and attractive are at 19, Princess Street in the centre of Shrewsbury Town. Mr. Jack Elliot, who comes from the Chester district, will be the branch manager and he will have a salesman, Mr. W. E. Lewis, and four engineers to cover Shropshire and central Wales. A dinner party was held in Shrewsbury after the opening and was attended by all the executives of Walkers (Liverpool) Ltd., and the salesmen and engineers involved in the new operation. This is the third branch to be opened by Walkers in a comparatively short period, the others being at Chester and Colwyn Bay. It is expected that the new service depot and sales office at Shrewsbury will not only prove of considerable benefit and convenience to local people but will also have the effect of increasing Frigidaire coverage in all the surrounding areas.

Bristol

One of the first examples of the new Bristol to emerge from the devastated areas left by the wartime blitz of 1942 is the recently completed offices and showroom of R. Alger & Sons Ltd., in Newfoundland Road, which were opened officially on Wednesday, April 30. Built on the site of the old Britannia Inn, the new buildings form part of the first stage in Bristol's planned expansion building programme for the area and have been scheduled for construction by the company since 1946. Their completion also represents the first step in a general expansion by R. Alger & Sons Ltd., who, as refrigeration specialists, were the first distributors in Britain for Frigidaire Division of General Motors Ltd., and have been distributors over a large area of South Wales and the West of England of Frigidaire products since 1926. In addition to the present premises the company has acquired adjacent property for future development as additional warehousing and work-shop space. Permission has also been granted for the construction of an accompanying car park area. Although the company have a head office in Newport, the premises in Newfoundland Road will form the base for operations south of the Severn and will house a large office staff, an engineering department for the design and installation of specialized refrigeration plant, a sales organization and a service department of 12 qualified engineers. In addition zone engineers will be on call at Bridgwater, Gloucester, Sherston and Trowbridge. One of the principal features of the new buildings is the spacious showroom which has been designed in contemporary style and in which the official opening ceremony took place on the evening of April 30. Among a number of distinguished guests who were present on that occasion was Mr. A. W. Porter, director and general manager of Frigidaire Division of General Motors Ltd., London.

are makers and nation-wide distributors of refrigerators, stores and plumbing products. They are a long-established concern and are considered to be a suitable connexion for United Kingdom firms.

Heat Pump & Refrigeration Ltd. have now added a new unit to their range of Heat Pumps production. The unit is called "Econom," which is a space cooler *cum* water heater. The unit has been especially designed for beer cellars, industrial kitchens, dairies etc., and wherever air cooling and hot water are required simultaneously. The range is from $\frac{1}{2}$ h.p. to 1 h.p., is completely self-contained and ready for installation. The unit can also be used in place of the existing water cooled condensing unit. The cooling capacity ranges from 4,500 to 9,500 B.t.u. per hour, and the hot water output 150 to 280 gallons per day.



Mr. Howard C. Davis, president, The Davis Products Co., 2222 South 11th Street, Niles, Michigan, has told the British consulate at Detroit that he would like to get into touch with United Kingdom manufacturers who could supply his company with absorption type, gas-operated refrigerating systems, or mechanisms, for installation in cabinets of Davis manufacture. It is understood that probable requirements would run into thousands of units per annum. A leaflet describing the refrigerators made by the Niles firm is available from the Board of Trade in order of receipt of applications. The Davis Products Company

Congratulations to Mr. R. Stancliff, M.C., A.INST.R., assistant manager, Royal Mail Lines, who was appointed a director on June 1, to fill the vacancy on the board caused by the retirement of Mr. A. Lawrence.

FRIDGES DISPLAYED AND DISCUSSED AT B.E.P.C.



At the 10th British Electrical Power Convention held at Brighton last month, displays of domestic refrigerators were staged on half a dozen stands. Easidene featured their 4.2 c.ft. refrigerator (model 4200), Electrolux put on their full range, giving pride of place to their L.37 and L.24 cabinets while English Electric gave a good position to their slim-line, table top and 8.4 c.ft. models among their other appliances. General Electric made an attractive display of their 6 and 8 c.ft. cabinets and Hotpoint showed "domestics" which are available either as build-in-models without table top or with table tops in five colours.

IN his paper "The development of the electrically-equipped kitchen," Mr. J. I. Bernard, M.I.E.E., director and secretary of the British Electrical Development Association, said, in part:—

"The development of the electrically-equipped kitchen is an historically recent development but one which is now making rapid progress. Two or three generations ago the larger houses in this country had kitchens in which a coal-fired cooking range was the dominating feature and the furniture a table in the middle of the room and a dresser at one side. There were also cupboards and an earthenware sink in an adjoining scullery. Other houses followed the same plan but on a smaller scale with a cottage range and water for cooking and washing up obtained from a standpipe or well. Then came the gas stove, early examples of which needed almost as much manipulation as the coal range but were appreciated for the ease with which a kettle could be boiled without lighting a fire," said Mr. Bernard.

"The first world war practically put an end to the domestic service on which the large houses had formerly depended and, without cook or kitchen maid to look after a coal fire, gas stoves became popular because they saved labour and were easier to control. But already in the 1920's electricity was beginning to be sold at relatively low prices for cooking and heating and a number of electric cookers appeared on the market. At first they were rather similar to the gas cookers of that day, but the superiority of an electrically-heated oven was soon appreciated and improved methods of construction began to remove the initial drawback of slow heating.

"During the 1930's other electrical appliances, such as washing machines and refrigerators, were introduced and began to impress housewives with their labour saving advantages, not only in reducing drudgery but also by being so much cleaner and more hygienic than older methods. These advantages were first realised in the housing estates built between the wars, where the housewives not only had to do all their own work but spent most of their time in their kitchens, which they liked to be clean and easily kept clean.

"The slow growth in the use of refrigerators in Great Britain may seem to the outside observer to be almost a national disgrace. In the United States the annual production of refrigerators is greater than the total number in use in this country, while in many other countries the production is in excess of this country as will be seen from the following table:—

	Annual Production of Refrigerators million	Percentage of households with Refrigerators
U.S.A.	3.7	94
Germany	0.75	18
France	0.35	12
Canada	0.35	84
Australia	0.3	71
U.K.	0.3	10

"The reasons for the relative backwardness of this country are not far to seek, the most obvious being purchase tax and credit squeezes, the former now somewhat relaxed. For the rest, it may be said that the British public are not 'refrigerator minded.' Perhaps the principal reason is the infrequent occurrence of spells of hot weather lasting long enough for all the food in the larder to 'go off.'

"In blocks of flats it usually is difficult to plan a cool larder for every flat and so refrigerators have been provided by the property owner and tenants have come to appreciate their value. In other urban property, however, there are generally regular deliveries of milk and other perishable food and so the housewife has rather tended to rely—whether she realises it or not—on the shopkeeper's refrigerator instead of insisting on having one herself. Trends in food distribution practice may change the situation considerably. For example, delivery of milk on alternate days is being mooted as a remedy for the difficulty of recruiting labour for this dull kind of occupation. Certainly housewives who go out to work realise the advantage of being able to do a week's shopping at a time, knowing the food will be kept in a hygienic and perfectly safe condition in their own refrigerators. Another advantage of a refrigerator which is beginning to be appreciated is the provision in new models of storage space for the quick-frozen food which is such a boon to the busy housewife because it saves time in preparing a meal. A still more valuable facility, particularly for those living in rural areas who, naturally appreciate refrigerators much more than their cousins in the towns, is the provision, in somewhat larger refrigerators, of a compartment in which small quantities of food can be frozen and kept safely for many months. A separate home freezer chest for long term storage of larger quantities of food is an additional appliance which is very helpful in the country house and farmhouse. At these low temperatures food spoilage can be entirely arrested and many articles which otherwise have to be obtained every day, for example bread, can be kept for long periods as fresh as anyone can desire.

"That the design of British made refrigerators is as good as any and better than most, is proved by the large proportion exported, as shown by the following table:—

U.K. MANUFACTURERS' DELIVERIES OF DOMESTIC REFRIGERATORS

Year	Home	Export
1951	149,000	230,000
1952	75,000	165,000
1953*	115,000	130,000
1954*	170,000	155,000
1955	225,000	110,000
1956	190,000	120,000
1957†	220,000	120,000

* Estimated from value figures.

† Estimated.

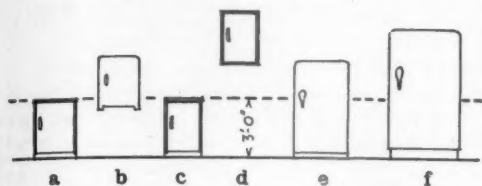


Fig. 1.—Basic types of refrigerators: (a) Large capacity table top type; (b) table type model; (c) compact table top; (d) wall-hung; (e) small cabinet; (f) large cabinet.

"Even so, if the home market were larger production costs would be reduced and then a still greater number of refrigerators could be exported.

"Although great advances have been made in the details of design and construction of compressor type refrigerators, including the production of hermetically sealed systems which are so reliable that they are guaranteed for five years, the simple absorption type refrigerator continues to hold its own for the smaller cabinets. Improvement has been made in the efficiency of this method in which heat instead of a compressor is used for promoting the circulation of the refrigerant. Small over-all size is, in fact, almost essential in most British kitchens where floor space is so limited. The smallest sizes of cabinet are made in table top style, and some of them may be built into a suitable kitchen cabinet. One of the newest models can be used in either of these ways or, alternatively, may be hung on the wall at eye level, where there may be more space in some small kitchens.

"In new houses and flats, and especially in old houses which have been converted into flats—as so many of them are nowadays—a refrigerator of adequate size is a much better investment from the point of view of the owner of the property than the bricks and mortar and valuable floor space, which would otherwise go to the making of a larder. If the refrigerator cabinet is not one of the large models which has a fitted storage bin for vegetables, it is advisable to provide a ventilated food store for keeping vegetables, but a relatively small cupboard will suffice and this can be readily constructed against an outer wall with an air-brick for ventilation. Anyone with experience of such an arrangement knows that it is vastly superior to the conventional larder, especially when this is not on a north wall.

"There is no doubt, therefore, that architects of houses built for owner occupation should come to realise that a refrigerator is far better than a larder and, in some cases, will cost no more. In this connection, it is of interest to note that in Sweden where formerly the provision of a larder was mandatory it is now permissible to install either a large (7 c.ft.) refrigerator or a combination of a refrigerator half this size and a 'cold larder,' which is a cabinet similar to the refrigerator mounted alongside it and with a certain cooling effect through the dividing wall which keeps the temperature down to 10° C. (50° F.). Doing away with the larder assists the architect in planning the house to the best advantage since the kitchen where the housewife spends a good deal of her time can be planned to catch the sun during the morning.

"For council and other rented houses the landlord cannot, of course, be certain at present that the tenant will have a refrigerator and so a larder is generally provided, although not required by model by-laws, but it is to be hoped that more and more housing authorities will arrange schemes for their tenants to purchase refrigerators by payments collected with the rent. Alternatively, housing authorities charging economic rents may decide to provide refrigerators as landlord's fixtures in at least some of their properties," declared the author.

"As already stated, the disruption of any of the three main groups is not to be recommended, but if there is no better solution, the refrigerator itself can sometimes be detached without seriously affecting the efficiency of the plan, but only so long as it remains no more than a step or so from the preparation counter, as shown in figures 3 and 4, which also show how it should be linked with the work counters within the working area of the kitchen. In cases such as these the larger size of cabinet type refrigerator

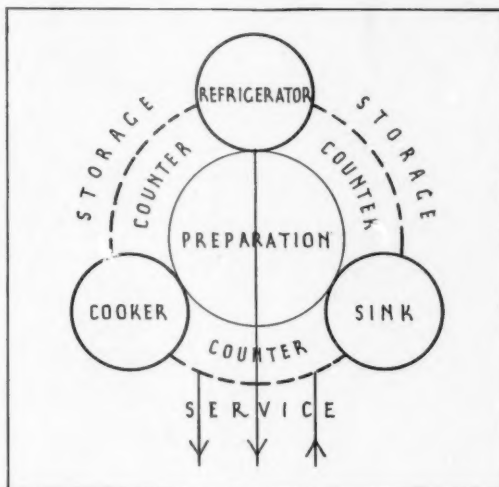


Fig. 2.—Diagram showing basic grouping of kitchen equipment.

comes into its own, and full advantage can be taken of the additional refinements it has to offer as its bulk does not become a hindrance to the layout of an efficient working area. On the other hand, if cupboard space is lacking, it may be necessary to use a more compact refrigerator of smaller capacity or even a table top model in order to accommodate cupboards for groceries and dry goods above."

(Continued on next page)

New Range of Food Cabinets

METALCRAFT, of Loughborough, are now marketing a range of food cabinets for both deep-frozen and chilled products under the name of "Metcold."

Their long experience in low temperature work has now been directed into domestic and trade channels. The company are supplying cabinets of all normal unit lengths, in addition to special sizes to customers' own requirements.

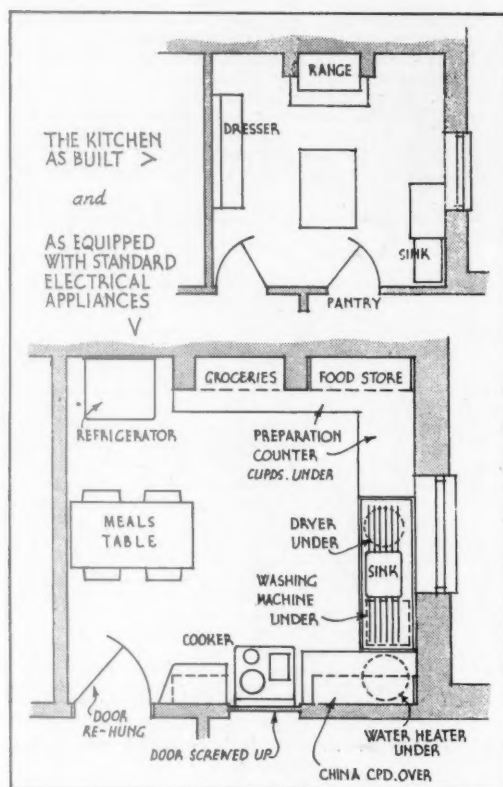


Fig. 3.—How standard appliances can improve an existing kitchen.

Sarco Laminated Wood Products Ltd. announce that they have acquired the complete sheet extrusion equipment of Ashdowns Ltd. The addition of this plant, to the machines already operating "round the clock" at Sarco's Cowes

factory, will provide increased output of Saroy high impact polystyrene sheeting and reduce delivery times. Saroy sheet is being used in increasing quantities in Great Britain and enjoys a very wide export market. The company does not custom form

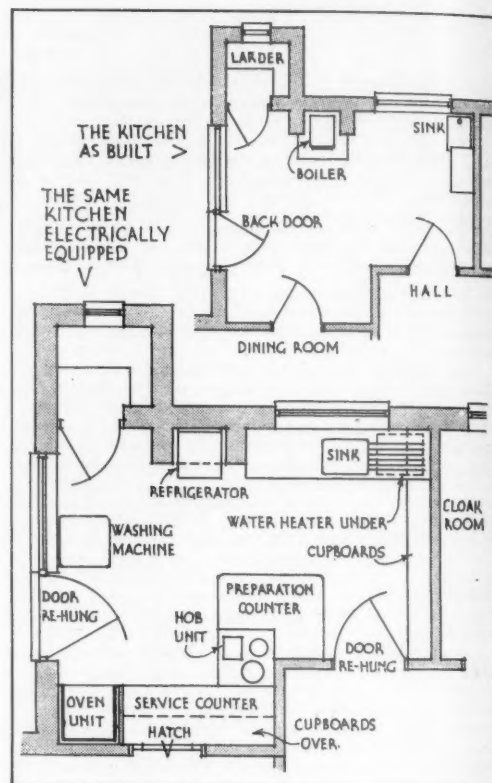


Fig. 4.—Dealing with a more difficult case.

Saroy sheet but its technical service laboratories are always available to assist sheet users and all companies enquiring for formings are put directly in touch with firms who specialize in this work.

New American Cryostat for Precise Temperature Control

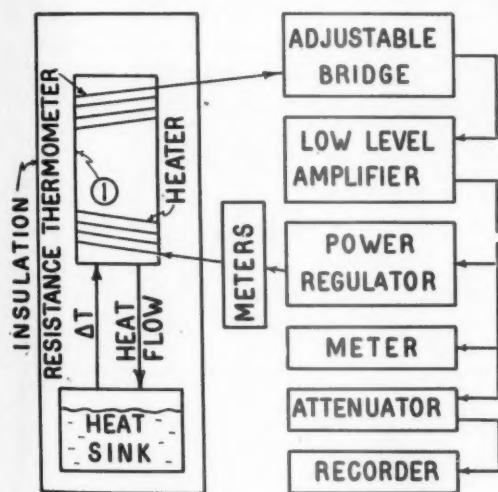
THE Cryogenic Engineering Laboratory of the U.S. National Bureau of Standards' Boulder (Colorado) Laboratories has recently developed a cryostat that is useful for low-temperature research concerned with the behaviour of electronic

elements such as a quartz crystal oscillator frequency standard. The work was done in connection with a U.S. Army Signal Corps Engineering Laboratory project.

By employing several convenient liquefied gases successively as refrigerants, the cryostat controls the temperature of an electronic element over a wide range of temperatures—at essentially any value between the boiling point of liquid helium and room temperature. The precision of control ranges from approximately one-hundredth to one-thousandth of a degree.

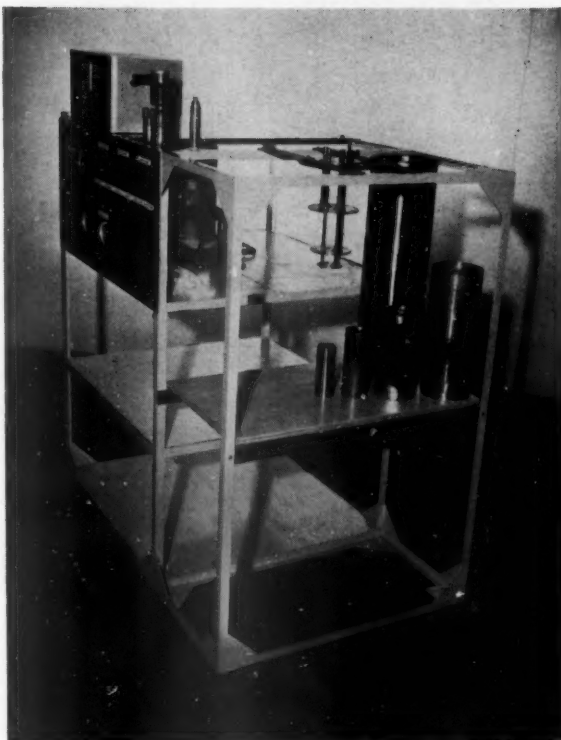
Although numerous cryostats for particular

purposes have been described in technical publications, some additional design problems are posed in providing an easily adjustable control system for such a wide temperature range. A method must be provided for obtaining temperatures between those of the available liquefied gases. The system adopted by R. D. Goodwin, of the Cryogenic Engineering Laboratory, is analogous, in principle, to the operation of an ordinary household electric oven. A thermometer or thermostat in the oven automatically adjusts the electric heat input to balance exactly the heat loss to the cooler environment. The environment employed in the cryostat is at the very low but slightly variable temperature provided by a liquefied gas, such as liquid nitrogen, which is allowed to boil freely at atmospheric pressure. Thermal conduction between "oven" and environment is controlled by adjusting the pressure of a gas employed for heat transfer in the intervening space. The "oven" contains a thermometer and an electric heater. Manual adjustment of the gross level of heating determines how "hot" the cryostat "oven" will



TEMPERATURE-CONTROL
DIAGRAM

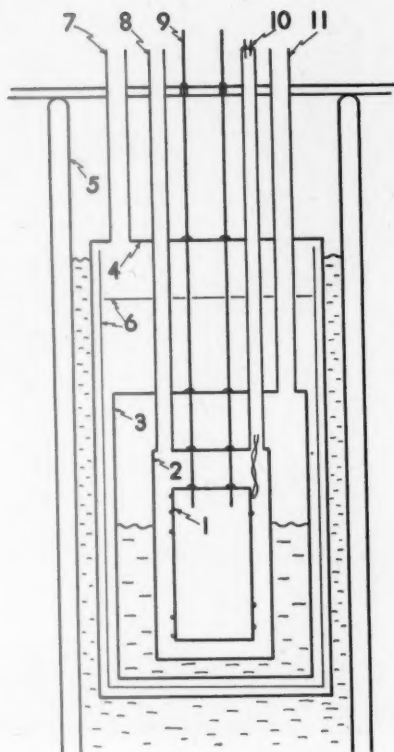
A block-diagram of the electric temperature-control circuits for a cryostat developed recently by the Bureau for wide range temperature control. The "oven" to be controlled is indicated by the encircled numeral 1. Changes in the temperature of 1 produce an electric signal from the adjustable electric bridge, of which the resistance thermometer is an element. The highly amplified signal is employed to produce a heat effect in 1 which will oppose the temperature change. A power regulator permits utilization of this sensitive control at different levels of temperature obtained by manual adjustment of the level of steady heat input.



Photograph of cryostat developed recently by the U.S. National Bureau of Standards for precise, wide-range temperature control. At right are the five disassembled concentric vessels. The smallest, at left, contains the experimental item. It is temperature-controlled. The next smallest holds a vacuum for insulation. It is surrounded when assembled by a cold liquefied gas, which, in turn, is surrounded by another insulating vacuum. For operation with liquid helium inside the cryostat, the entire assembly must be surrounded by liquid nitrogen held in the largest cylinder shown, which is a stainless-steel Dewar vessel with double walls. On the left is part of the pumping system, with valves and gauges required for vacua and the handling of gases.

be compared to the liquefied gas refrigerant. Automatic control of the heating at this level maintains a constant temperature, despite small changes in the temperature of the liquefied gas environment or heat effects produced in the "oven" by test elements.

The cryostat employs electric resistance thermometers in electric bridge circuits which have been designed both for ease of adjustment over a wide temperature range and for optimum practical sensitivity per unit electric power developed in the thermometer, since the latter is a limitation upon resistance thermometers. The maximum allowable change of temperature of the cryostat "oven" produces a useful signal from the resistance thermometer bridge of the order of one microvolt. Utilization of such a small signal for temperature



A schematic diagram of concentric vessels of the cryostat proper, corresponding to the assembly photograph. "Oven" 1 is insulated by vacuum held in 2. The liquefied gas refrigerant contained in 3 is protected from room temperature by vacuum container 4 and radiation shields 6. For the lowest temperatures in 3, heat leak is further reduced by means of an inexpensive refrigerant at intermediate temperature contained in the Dewar vessel 5 as shown. The entry pipes are thin-walled stainless steel of low thermal conductivity.

control requires an electronic amplifier with a gain of about 1,000,000. The amplifier must not drift nor produce spurious signals (noise) greater than about one-tenth of a microvolt. The amplified signal then is applied to an electronic power regulator for control of the electric heating of the cryostat "oven."

References

- GOODWIN, R. D. (1957). "Design of Simple dc Resistance Thermometer Bridges for Wide-Range Temperature Control." *Proceedings of the 1957 Cryogenic Engineering Conference*. (August 19.) Boulder, Colorado.
- & PURCELL, J. R. (1957). "Direct-Coupled Power Amplifier for Cryostat Heating Control." *Review of Scientific Instruments*, 28, 581.

LARGE NEW REFRIGERATED CARRIER

AN important British meat processor and distributor, Louis C. Edwards & Sons (Manchester) Ltd., has added a 1,000-c.ft. capacity Leyland Comet-Scammell articulated outfit to their large fleet of refrigerated vehicles. It is the largest unit to be purchased by the firm, and, according to Mr. John Peel, the company's transport manager, is the type on which they intend to standardize.

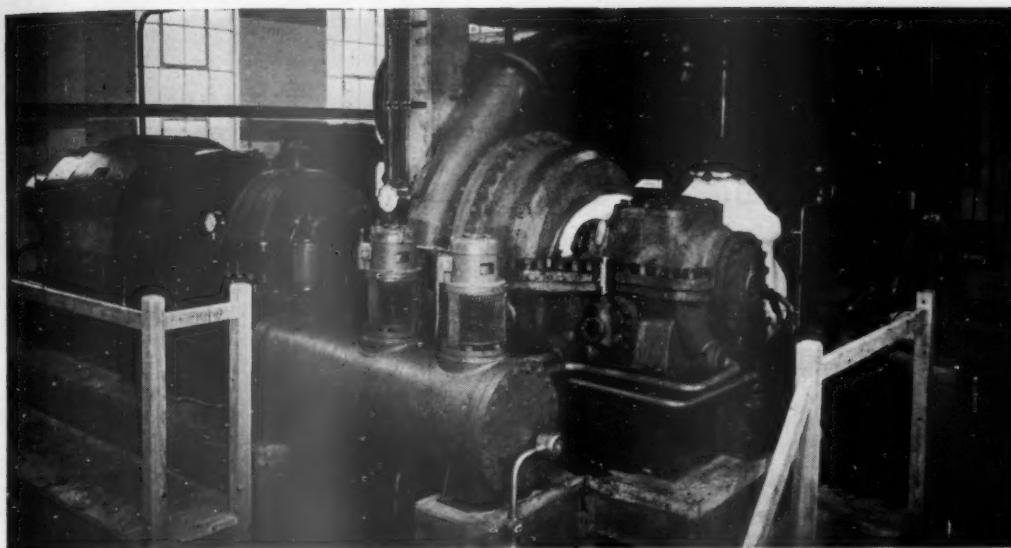
The tractor is a two-axled forward-controlled Leyland Comet equipped with Scammell automatic coupling gear. With this gear, coupling and uncoupling is controlled from the cab. Mann Egerton & Co. Ltd., of Norwich, built the body which is steel-panelled with aluminium internal walls and light alloy chequerboard flooring to the specification of Mr. D. J. Edwards.

A 6-in. layer of Onazote between the walls insulates the body which is operated at a temperature of -10° to -14° F. The body is cooled by a Frigidaire AD5 refrigeration unit driven by a Vincent petrol engine, both housed in an under-slung side compartment below floor level. It can also be operated electrically from the mains supply.

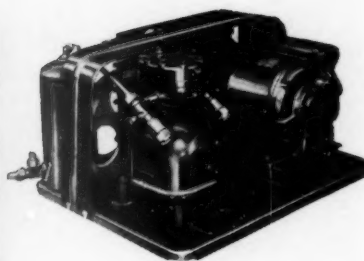
This van is the forerunner of a fleet of similar vehicles which are to be purchased because, in the words of Mr. Peel, "It has cheapened our costs by doing the job of two normal refrigerated vans." It is being used as an all-purpose vehicle by Edwards for the delivery of their meat and frozen packs to docks where they are shipped to four continents. On return journeys it carries meat from Liverpool, London, Newport or Bristol. With payloads which often weigh up to 12 tons, the outfit is returning an average fuel consumption



of 10 m.p.g. In addition to shipping meat and frozen packs overseas, the firm is also responsible for supplying meat to all Manchester schools, the majority of all Lancashire, and other school authorities and similar establishments.



Refrigeration for all Commercial and Industrial Purposes



J. & E. Hall Ltd. manufacture refrigerating compressors for all commercial and industrial purposes ranging from $\frac{1}{8}$ h.p. to over 1000 h.p.

J. & E. HALL LIMITED
DARTFORD KENT

REFRIGERATION, LIFT AND ESCALATOR ENGINEERS

AP 115

Cold Storage Affairs in Scotland

THE 19th annual general meeting of members of the Scottish Association of Cold Storage and Ice Trades was held in Aberdeen last month under the chairmanship of Mr. W. A. P. Milne, president. Attending were Mr. E. C. Malcolm (Aberdeen Market Co. Ltd.), Mr. D. Knowles (Bon-Accord Ice & Cold Storage Co. Ltd., now Aberdeen Ice Co. Ltd.), Mr. T. Hamilton (Buttercup Dairy Co. Ltd.), Mr. A. Ferguson (The Clyde Cold Storage Co. Ltd.), Mr. M. Lawson (The Dundee Ice & Cold Storage Co. Ltd.), Mr. P. A. D. Gardner (The Edinburgh Ice & Cold Storage Co. Ltd.), Mr. A. Reid (The Fraserburgh Ice & Cold Storage Co. Ltd.), Mr. G. W. Will (The Fraserburgh Ice & Cold Storage Co. Ltd.), Mr. J. H. Dunningham (The Granton Ice Co. Ltd.), Mr. H. A. J. Macpherson (Wm. McLachlan & Co. Ltd.), Mr. J. F. McArthur (Wm. Milne Ltd.), Mr.

R. Finlay (Wm. Milne Ltd.), Mr. J. Kilgour (New Standard Cold Storage (Aberdeen) Ltd.), Mr. J. Mackenzie (The North British Cold Storage & Ice Co. Ltd.), Mr. F. Worling (The North Eastern Ice Co. Ltd., now Aberdeen Ice Co. Ltd.), Mr. C. Birse (Northern Co-operative Society Ltd.), Mr. D. H. Swankie (Scottish Co-operative Wholesale Society Ltd.) and Mr. Kenneth Walker, C.A. secretary. Visitors included Mr. J. E. G. Ruddin, president, The National Federation of Cold Storage & Ice Trades, Mr. M. Wyllie, L. Sterne & Co. Ltd., Mr. C. A. Fearon, manager, Union Cold Storage Co. Ltd., Glasgow, Mr. A. D. Hillhouse, general manager, National Cold Stores (Management) Ltd., and Mr. D. T. Lee, secretary, The National Federation of Cold Storage & Ice Trades.

On the motion of Mr. W. A. P. Milne, the retiring president, seconded by Mr. H. A. J. Macpherson, Mr. James Mackenzie (The North British Cold Storage & Ice Co. Ltd.) was unanimously appointed president of the Association.

Mr. Mackenzie then occupied the chair and on behalf of the members of the Association expressed thanks to Mr. Milne for all he had done on their behalf during his term of office as president.

On the motion of J. Mackenzie, seconded by Mr. J. Kilgour, Mr. Alex. Ferguson (The Clyde Cold Storage Co. Ltd.) was unanimously appointed vice-president of the Association.

Mr. D. H. Swankie (Scottish Co-operative Wholesale Society Ltd., Aberdeen), having been duly nominated, was appointed to the committee as a representative of the north district, in place of Mr. W. A. Thompson (The Moray Ice & Cold Storage Co. Ltd.) who fell to retire at this time.

On the conclusion of the formal business of the meeting a film entitled "Operation Frigid" dealing with the mechanical handling of goods in and out of cold store was shown followed by a short discussion on this important subject.

The meeting terminated with a vote of thanks to Mr. W. A. P. Milne and to Mr. J. Mackenzie for their conduct of the proceedings.

The annual dinner of the Association was held as usual within the Imperial Hotel, Aberdeen, when Mr. James Mackenzie, the new president of the Association, presided.

The toast list was as follows:—

"The Association," proposed by Mr. J. E. G. Ruddin and replied to by Mr. James Mackenzie.

"The Guests," proposed by Mr. Alex. Ferguson and replied to by Dr. George Reay.

"The Artistes." A vote of thanks was proposed by Mr. Mitchell Lawson.

The annual golf competition was played as before over the course of the Royal Deeside Golf Club at Banchory when the prize-winners were as follows:—

Scratch—W. A. P. Milne, Glasgow.

Handicap (First class)—First and second equal: F. D. Lawson (Dyce) and M. Lawson (Dundee).

Handicap (Second class)—First: D. Knowles (Aberdeen); second: J. Coull (Aberdeen).

Visitors' prize: D. Marnoch (Aberdeen).

Ladies' prizes—First: Mrs. A. Ferguson; second: Mrs. A. D. Hillhouse.

The whole proceedings were carried through on the usual lines and proved to be as successful and enjoyable as ever. The golf competition took place in bright sunshine and the course and surroundings at Banchory were looking at their best.

(Points from the president's report are given on p. 718.)

Top, left to right: M. Lawson (The Dundee Ice & Cold Storage Co. Ltd.), F. D. Lawson (Robert Lawson & Son (Dyce) Ltd.), James F. McArthur and W. A. P. Milne (Wm. Milne Limited). Bottom, left to right: J. H. Dunningham (The Granton Ice Co. Ltd.), James Mackenzie (North British Cold Storage & Ice Co. Ltd.), H. A. J. Macpherson (Wm. McLachlan & Co. Ltd.), and Mrs. Alex. Ferguson.



Refrigeration Controls—7

PRESSURE-OPERATED TYPES

By H. H. EGGINTON

(Continued from June issue)

Evaporator Pressure Regulators

THE object of the evaporator pressure regulator is to prevent the evaporator pressure from falling below a pre-set pressure and, therefore, temperature. The valve senses the upstream, or evaporator, pressure and opens or closes, depending on whether the pressure is appreciably above or approaching the value to which the control is set. As the pressure rises, the valve opens allowing the compressor suction to unload the evaporator and as the compressor gradually causes the evaporator pressure to fall, the valve throttles down restricting the passage of vapour from the evaporator to the compressor, hence restricting the fall of evaporator pressure. This control, therefore, can be likened to a large orifice constant pressure valve working backwards, *i.e.* sensing the upstream and not the downstream pressure; such valves are used wherever a minimum evaporator pressure or temperature condition is required and they can be applied to plants having thermostatic expansion valves, high or low side floats, or other forms of flooded evaporator level control system, but not constant pressure expansion valves.

The need for evaporator pressure regulators is emphasized when the simple control of a compressor by an on/off method of operation by the action of the pressure switch or thermostat is inadequate for the sensitivity of control required in the plant. They are also used where more than one evaporator is required running from a single compressor and each of the evaporators is running at a different temperature. Application of evaporator pressure regulators to a multiple evaporator system has to be done with some care and this is described later. The capacity of these controls is very similar to that of the constant pressure valve, insofar as it is a function of the orifice size and discharge coefficient characteristics, pressure system rate and the pressure drop across the orifice. But the control should be capable of giving rated capacity of refrigerant flow with an evaporator pressure change of the order of 4 to 7 p.s.i. *i.e.* go from closed to rated open

position. On a single evaporator application, such a regulator should be selected for the required capacity at a minimum pressure drop, and at the lowest expected operating evaporator temperature and pressure. On a multiple evaporator installation, the regulator must be sized by taking into account the large pressure drop, due to the evaporator feeding a much lower suction pressure. The regulator being installed on the highest pressure evaporator, there is a pressure drop across the valve proportional to the temperature difference of the evaporators and the suction of the compressor. It should be emphasized that, apart from controlling evaporators for critical temperature conditions such as in water chilling and food storage, one of the main uses of the evaporator pressure regulator valve is to economize in plant costs, *e.g.* multiple installations of one compressor where considerable care must be taken in the application of these regulators.

Principal Requirements

(1) The valve should be so constructed that it does not show erratic tendencies under the relatively arduous pressure and temperature conditions under which it has to operate; it should be effectively sealed against the ingress of moisture depositing on the power element, otherwise frost or ice may give erratic performance.

(2) The valve should be so constructed that the suction pressure does not give an appreciable change in setting point as the suction pressure varies, this being primarily a problem of port areas in relation to prime mover.

(3) The regulator should have a low operating differential or hysteresis and should be capable of changing direction of movement with a pressure change not greater than 1 p.s.i. It should additionally be capable of going from closed to open to rated capacity in 4 to 7 p.s.i. change in pressure.

(4) The valve should have a good range of adjustment, preferably of the order of 20 in. mercury vacuum to 50 p.s.i. pressure as one primary range of requirement, with a further

range for higher pressure refrigerants of 20 p.s.i. to 70 p.s.i. Considerable useful service can be obtained from a valve with a range of 0 to 40 p.s.i.

(5) The materials of construction of the valve mechanism must pay particular attention to the problems associated with high velocity gas passing through the valve, and must not allow "bedding in" which might give a drift in set point.

Constructional Details

In materials of construction these valves are very similar to constant pressure valves, utilizing brass bodies, brass bellows or diaphragms of stainless steel or beryllium copper. In addition to brass seats and valve heads, stainless steel and bronzes are used and sometimes plastic type valve head materials. With ammonia types, cast iron or semi steel bodies are common with stainless steel for prime mover and valve mechanisms. Regulators are made with flare, sweat and flange connections, depending on size and type of duty. The servo principle of construction is used in pilot operated types of valve, although the relative areas of seat and prime mover are not so critical as with constant pressure valves or suction pressure regulators, because the pressure drop which can occur through the valve is smaller and hence the out of balance force on the seat is small in relation to the forces on the prime mover *i.e.* considerable variations in opening and closing points due to different suction and evaporator pressure do not occur because difference in pressure is small. With very large seats it may be necessary to compensate the seat area by a bellows (see fig. 17).

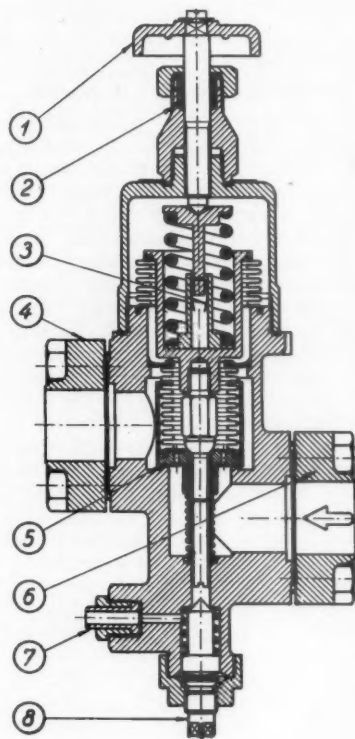
Operating Characteristics

Since these controls modulate to changes in evaporator pressure, that is, do not give on/off control, they can balance the output of the refrigeration system to the load, at the same time protecting against a pre-set minimum pressure condition at which they close and ultimately lead to stoppage of the machinery by pressure switch. Since an evaporator pressure regulator is not the primary refrigerant metering device in a system, and does not produce a constant evaporating pressure, only a lower limit control, then the disadvantages of the constant pressure expansion valve in respect of slow rate of pull down, reduction in evaporator efficiency etc., do not apply. However, applications with equaliser thermostatic expansion valves, or two temperature circuits, need very careful consideration unless far more serious complications are to be avoided. Problems of this kind will be discussed under "Application."

The advantages of the evaporator pressure regulator are :—

(1) Ability to limit temperature fall of evaporator without incurring penalties in capacity of machine or rate of pull-down.

(2) With a non-return valve enables more than one evaporator to be fed from one machine with temperature difference between evaporator.



By courtesy of Danfoss Manufacturing Company, Denmark.

Fig. 17.—Large seat evaporator pressure regulator

- 1 Hand wheel
- 2 Gland
- 3 Damping device
- 4 Discharge flange
- 5 Valve seat
- 6 Inlet flange
- 7 Pressure gauge connection
- 8 Pressure gauge valve.

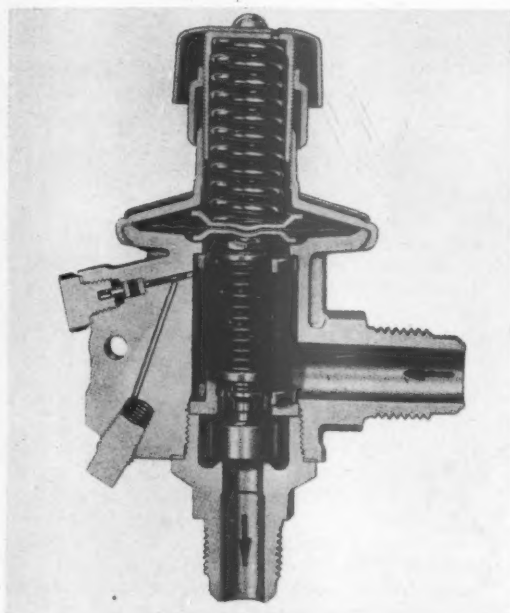
(3) Can be applied to a variety of liquid metering systems, *e.g.* thermostatic expansion and float or level systems—not, however, to constant pressure valves.

Disadvantages

(1) They are pressure controls and on critical applications may not be sufficiently sensitive, particularly if the rate of heat transfer from medium to be cooled to evaporator is not good. In such a case a thermostatic evaporator regulator may be considered.

(2) In some applications pressure drop through the valve may give a capacity penalty.

(3) Application to multi-temperature circuits from a common compressor and when used with equalized line thermostatic expansion valves, the installation may become critical, and plant capacity or degree of control, sacrificed.



By courtesy of A.P. Controls Corp. U.S.A.

Fig. 18.—Evaporator pressure regulating valve.

Operation

Fig. 18 shows a typical evaporator pressure regulator, the horizontal connection being made to the evaporator through which pressure is transmitted to the flexible diaphragm which is opposed by the spring in the head of the valve. When the pressure in the evaporator is above the minimum permitted, the valve is opened. As the pressure falls, so the diaphragm and therefore the valve moves downwards and the valve is closed. A similar pattern of valve can be fitted to a servo valve similar to those described in a previous

article so that the outlet of the valve can transmit pressure to a piston and so open and close a larger valve or cause it to modulate in sympathy with the pilot.

Application

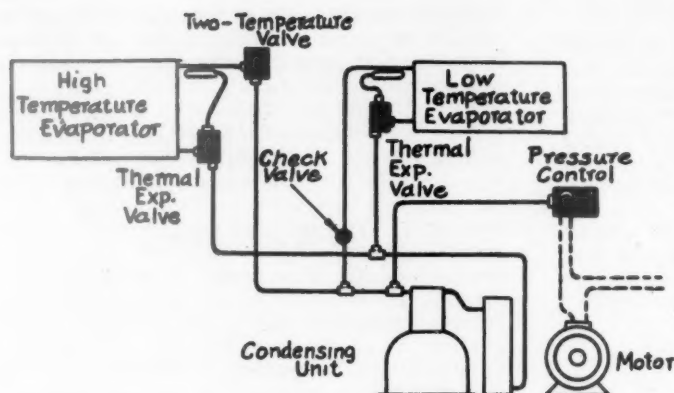
As previously explained, the sole purpose of these controls is to prevent evaporator pressure, and therefore temperature, from falling below a set point. Two principal uses are made of this control—(1) on single temperature evaporator circuits and (2) multi temperature evaporator circuits. In all cases the control is installed between the evaporator and suction lines.

Single Temperature Evaporators

Typical applications are ice cream freezers, water coolers, beer coolers and brine chillers; in all these cases freezing of this medium or excessive low temperature is to be avoided. In vegetable storage and similar applications the controls are used particularly with blower type finned evaporators, so that a large difference in temperature between the forced air and the evaporator, or temperature split, is avoided and hence dehumidification of the air does not take place.

Multiple Temperature Evaporators

Fig. 19 shows the typical arrangement of a two-temperature system from a common condensing unit. An evaporator pressure regulating valve, or two temperature valve (as shown in the diagram) is fitted to the higher temperature evaporator and a check valve or non-return valve fitted to the lower evaporator, the check valve being used to prevent any high temperature vapour from the higher temperature evaporator from entering the low temperature evaporator. Other points of significance on this diagram are the use of thermostatic expansion valves, which permit the satisfactory exploitation of this two temperature system, also the use of a pressure control, the cut out point of which must, of course, be set for the lowest temperature evaporator, i.e. to cut out when the lower temperature evaporator has gone as low as is desired. On the other hand, the cut-in point of the pressure control must be set above the opening pressure of the evaporator pressure regulator, that is to say, a wide differential pressure control will be required. If this is not done the rapid rise in pressure in the suction line as a result of the machine being stopped will cause the pressure switch to cut in again and short cycling will result. Thermostats, one fitted to each room or compartment in which the evaporator is operating, will produce, if connected electrically in series, a more accurate control of temperature, since they respond in relation to the load and room



By courtesy of A.P. Controls Corp., U.S.A.

Fig. 19. — Typical two-temperature system from a common condensing unit.

conditions and not in relation to the pressure in the pipe work as the pressure control. However, this latter form of control by thermostatic switches is less common on account of increased initial expenditure.

Check Valve (see fig. 20)

Earlier it was commented that the use of a check valve in the lower temperature evaporator line was to prevent the vapour from a high temperature evaporator flowing into the lower temperature evaporator. This may increase the temperature of the lower temperature evaporator very considerably, and may even cause flooding of this evaporator by condensation of the higher temperature vapour during an off cycle. This can then become extremely serious at start up of the compressor, since this flooding may lead to flood back to the compressor when it again starts a cycle.

Fundamental Rules for Two Temperature Systems

- (1) The difference between highest and lowest evaporator refrigerant temperatures should not normally exceed 20° F.
- (2) The heat load on the higher temperature evaporator, *i.e.* the one with the evaporator pressure regulating valve, should be the smaller proportion of the total heat load on the unit, *i.e.* less than 50, per cent. if possible. Generally speaking the smaller the proportion of heat load on the higher temperature evaporator, the better the overall performance of the system will be.
- (3) Constant pressure expansion valves should not be used and thermostatic are recommended.

Comments on the Application of Evaporator Pressure Regulators with Thermostatic Expansion Valves having equalizer line connexions.

The reason for expansion valves having equalizer line connexions will be explained in the chapter dealing with thermostatic expansion valves. However, where such types of valves are used with evaporator pressure regulators, some care has to be taken that the connexion of the equalizer line of the expansion valve at the end of the evaporator does not come sufficiently close to the evaporator pressure regulator and be of sufficient size to allow the two controls to respond sympathetically to each other in respect of pressure changes and to cause hunting, that is to say, a wide swing of control conditions as a result of each control responding to the other. The only course in such a case is to attempt to move the equalizer connexion back along the evaporator in the direction approaching the site of the thermostatic expansion valve. This, however, should be done with great care since if the connexion of the equalizer line is taken too far back the whole advantage to be gained from an equalizer type valve will be lost. It may, however, in some cases be necessary, to meet optimum conditions, to take an equalizer line connexion half way back through the evaporator, *i.e.* in the mid position between the beginning and the end of the evaporator pipe work. In addition to equalizer connexion problems, the use of an evaporator pressure regulator may also make the installation of the thermostatic expansion valve bulb difficult insofar as it may produce awkward pipe work resulting in a liquid trap. These are to be avoided if sensitive control of the thermostatic expansion valve is to be obtained, otherwise a hunting condition is set up by the accumulation and elimination of liquid being trapped in the pipe line. Generally, it is recommended that the thermostatic expansion valve bulb

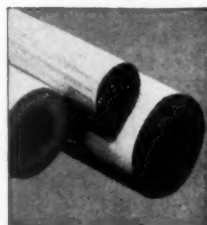


Resilient

ROCKSIL
ROCK WOOL INSULATION

That's the latest addition to this highly successful range of rock wool insulating materials. Great strength, accuracy of manufacture, and superior finish, along with all the usual properties of Rocksil, make these rigid sections an efficient means of insulation up to 600°F. For hot water lines, steam lines, and steam traced oil lines, Rocksil rigid pipe sections provide well-fitting and inexpensive insulation that is particularly resistant to corrosion.

Canvas or scrim wrapped, with or without bands
In 3 ft. lengths, thicknesses by $\frac{1}{2}$ " steps from $\frac{1}{4}$ " to 2". Uniform density 10 lb/cu. ft.



Full information available from the manufacturers :

THE CAPE ASBESTOS CO LTD 114 & 116 Park Street, London W.1. Telephone: GROsvenor 6022

and at: Glasgow: Eagle Buildings, 217 Bathwell St., Glasgow, C.2. Tel: Central 2175
Birmingham: 11 Waterloo St., Birmingham 2. Tel: Midland 6565-6-7

Manchester: Floor D, National Buildings, St. Mary's Parsonage, Manchester 3. Tel: Deansgate 6916-7-8
Newcastle: 19 & 20 Exchange Buildings, Newcastle-upon-Tyne. Tel: Newcastle 20455

site is on the evaporator side and not the suction line side of the evaporator pressure regulator.

The selection of an evaporator pressure regulator must first take into account the duty, whether it is to be used on a single or multiple evaporator application. If it is for a single evaporator application, then the capacity requirement of the

of evaporator pressure regulators, that is to say, 20° difference exists between the high and low temperature evaporator and normally this should not be exceeded unless very special considerations are being made in relation to the plant. On no account should regulators be selected oversize if reliable control is to be obtained.

TROUBLE SHOOTING

Symptoms

High pressure drop across the valve and loss of plant capacity.

Remedy

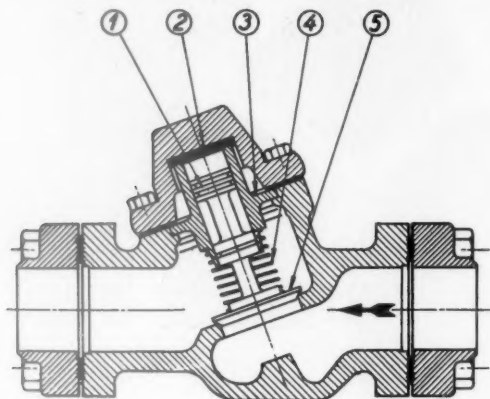
Valve undersize, check requirements against suppliers' data and select another valve if necessary. With internal or external servo types check for blocked port way, dirt or seized pistons. Clean and install filter.

Erratic control or hunting, or noisy operation.

Oversize valve, check capacity data against requirements and re-size if necessary. Defective valve or dirt in control particularly servo types, clean and install filter or replace.

Evaporator falling below setting or in serious case valve not closing.

Valve leaking, check dirt in valve—clean and check filters. Worn or eroded valve head or seat—replace.



By courtesy of Danfoss Manufacturing Company, Denmark.

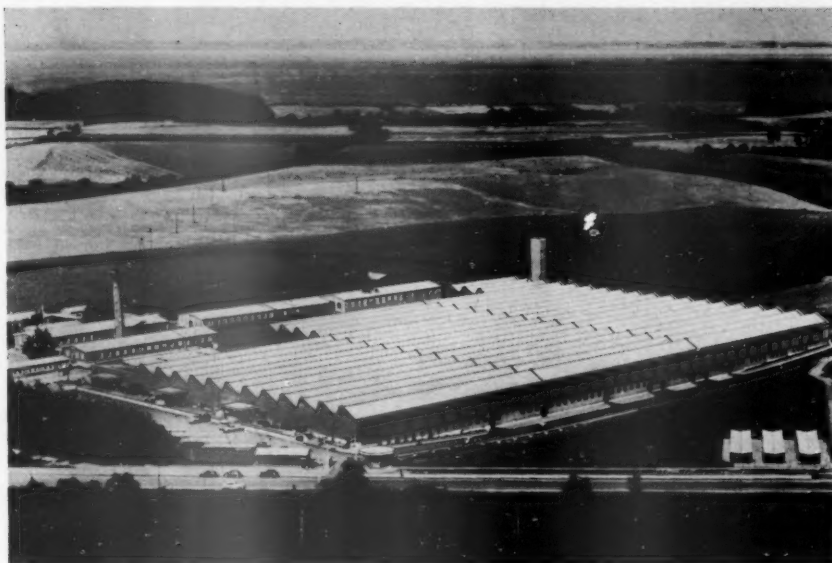
Fig. 20.—Check valve.

- 1 Damping piston
- 2 Rubber sheet
- 3 Guide bushing
- 4 Spring
- 5 Valve cone

valve should be based on the operating pressure and temperature of the evaporator under consideration. Such data is usually available from suppliers' data sheets and will normally cover pressure drops through the valve up to 2½ lb. p.s.i. or thereabouts, for a variety of evaporator temperatures. When the valve is to be selected for a multiple evaporator duty then the capacity selection of the valve must be based on a pressure drop which is obtained by subtracting the suction pressure at full load conditions from the pressure in the evaporator under control. Consider a machine on refrigerant-12 with an evaporator controlled to 40° F., i.e. 37 p.s.i.g. and an expected compressor suction under full load conditions of 17 p.s.i.g., then the pressure drop across the regulator will be 37 p.s.i.g. minus 17 p.s.i.g., which is equal to 20 p.s.i., from which a control can be selected from the suppliers' tables for the given capacity required on the control evaporator. It should be noted that with this example the difference in temperature of the two evaporators is at the limit generally recommended for the use

Herring Plant at Mallaig.—Within three months of a decision being taken to provide quick-freezing and cold-storage facilities at Mallaig, the Herring Industry Board announced last month that their plant there was in operation. The Board's intention to set up a plant of this kind at Mallaig was mentioned in their recently published annual report. A suitable site for the permanent installation will not become available this year, however, and it was therefore decided to make use of existing premises as an interim measure. The necessary apparatus was purchased and the work of erection was completed last month. The opening of the plant came at a time when the quality of herring being landed at Mallaig was showing a distinct improvement. Large-size herring are particularly suitable for kippering and quick-freezing on the spot. This is the third quick-freezing factory which the Board has constructed.

The Danfoss Story



A personal triumph allied to a great team spirit



Mr. M. Clausen, founder and head of Danfoss.

THIS July, the Danfoss Manufacturing Company of Nordborg, Denmark, celebrates its 25th anniversary. The story of the growth of this great organization, founded by Mr. M. Clausen in 1933 and still personally controlled by him, is sufficiently unique to have acquired an almost legendary flavour. But there is nothing closer to realism than the purposeful activity in this great factory now boasting 3,000 workers. The record sheet at Nordborg for 1933 showed the following "score": workers, 0; functionaries, 0; total, 0. In 1939, the figures were: 17, 9, 26, while in 1958 they are: 2,206, 794, 3,000!

Mr. Mads Clausen, who began this enterprise in an attic room, measuring 200 sq. ft. which is still retained as his office, is an outstanding example of "quiet dynamism"; while still retaining a very close grip on all essentials of factory planning and management, he has built up around him a team of specialists who relieve him of anxiety in all their separate spheres of activity. Perhaps the success of Mr. Clausen has been due as much to his ability to choose the right men as to any other factor. The team spirit at Nordborg has to be felt to be believed.

The team has a very benevolent leader. He has provided large housing estates for office and works people and all cases of hardship or illness are



Favourite pastime of Mr. Clausen is big-game hunting. Here he is with his record rhino kill. He has an exceptional collection of rifles and the one shown, British made, is perhaps his no. 1.

brought to his notice for attention. Houses can be rented for £5 a month.

The Danfoss team, headed by Mr. Clausen, has as its departmental chiefs the following gentlemen :

Technical department : Chr. Matthiesen, managing director ; O. Moller-Olsen, chief engineer ; P. Lindblad, sectional engineer ; Viggo Rasmussen, electrical engineer.

Building and maintenance department : T. Flindt, managing director ; E. Vestergaard, departmental head ; F. Strange, electrical engineer.

Construction department : M. F. Scholer, managing director ; Egon Nielsen, chief engineer, section I ; A. Enemark, chief engineer, section II ; K. Porland, chief engineer, section III.

Sales department : Chr. Morsbol, managing director ; Anker Larsen, departmental head, external ; F. Uekermann, departmental head, internal ; M. Ramlau-Hansen, secretary ; J. Molgaard, engineer.

Publicity and advertising department : R. Friese, publicity manager ; O. Lynnerup, assistant advertising manager ; J. Schmidt, advertising assistant.

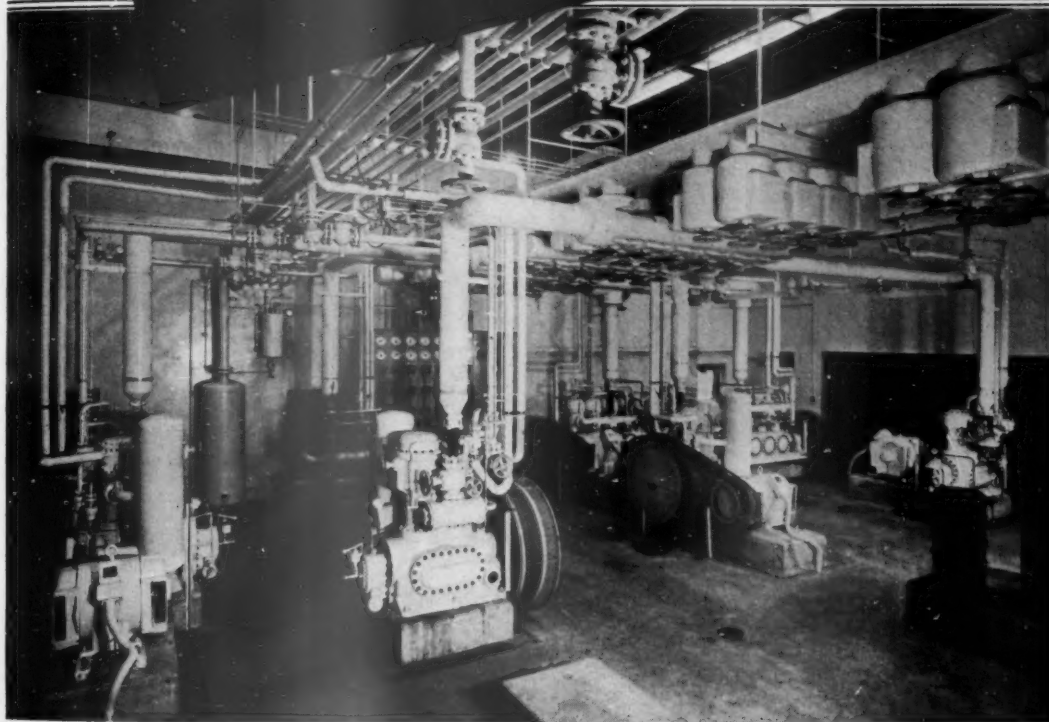
A description of the Nordborg plant appeared in these columns in 1955 although considerable expansion has taken place in the interval. A feature of this modern factory, which is surrounded by ample land for development, is that the service lines—heating, electricity, vacuum, etc.—are so

During the past 10 to 15 years an immense expansion of the existing towns around the factory has taken place, and new towns have been founded. Aerial view of Nordborg with the new part of the town in the foreground.



JULY 1958

KRAFT install STERNE



The photograph above shows part of the refrigeration engine room in the new factory for Messrs. Kraft Foods Ltd., at Kirkby near Liverpool.

L. STERNE & CO. LTD

(Incorporating Haslam Foundry & Engineering Co. Ltd.)

CROWN IRON WORKS, NORTH WOODSIDE RD., GLASGOW, N.W. Douglas 6461

SALES OFFICES AND SERVICE DEPOTS:

DERBY	Derby 45604	LONDON	Rodney 6300	LIVERPOOL	Royal 1281	ABERDEEN	Aberdeen 24914
BRISTOL	Bristol 24038					BELFAST	Belfast 59211
CARDIFF	Cardiff 26408	NEWCASTLE		66-1048		DUBLIN	Dublin 62705
		HULL		Hull 31198			

MODERN REFRIGERATION July 1958

705

E

placed that coupling up to new piping causes the minimum trouble and inconvenience ; the planners are, in fact, always thinking in terms of expansion and headers for connexion are usually only the depth of a brick wall away.

The factory and offices now have 500,000 sq. ft. of floor area and to heat the many shops and rooms 12,000 tons of oil are used every year.

As will be well known, the Danfoss organization caters for the heating, as well as the refrigeration, industry ; in fact, the amount of work is almost equally divided between the two, if one does not take into account sealed refrigeration unit production.

In order to achieve a steady flow of useful (not necessarily skilled) workers into the factory, a very large apprentice section is maintained and is rightly regarded as one of the key departments. In connexion with this, one notices that in the machine shops much of the equipment is automatic. Indeed, many of the lathes and other machine tools are operated by erstwhile farm workers after two months' training ; their machines are, in fact, preset by skilled tool setters.

In order to give readers further glimpses of the operation and planning of this plant, it may be best to quote certain statements made by various departmental heads at a luncheon given by Mr. Clausen to technical editors from many lands last month :—

Mr. M. F. Schøler, managing director of Danfoss engineering division, said : "Danfoss have built their organization in such a way that we have six separate divisions, each headed by a director.

"It is obvious that a company like Danfoss, operating in the field of automatic controls in a time when the 'war cry' is 'Automation,' will be participating in developments on several frontiers.

"It is Danfoss's business to devise and produce controls for other industries to use, and the number of industries

we are supplying is great, and the variety of types of controls is still greater.

"In order to develop controls for these various industries one has to have experts within one's company who intimately know these industries, their technique and problems. How could one otherwise help them in their efforts of developing and perfecting these industries.

"However, one can divide the engineering work into three different categories :—

- (1) Perfecting the function of the automatic controls as they are used to-day.
- (2) Efficiently producing these controls of to-day.
- (3) Developing the controls of to-morrow.

"The need taking good care of 1 and 2 in order to be in business is obvious, but the need for doing something about 3, the controls of to-morrow, in order to stay in business is certainly not the least important point !

"The old slogan of being 'first with the most' also applies in the control business."

Mr. Chr. Morsbol, managing director of the sales department, said : "After the war when our competitors in Germany and England partly had suffered or first had to switch over from war to peace production, which was also the case in the U.S.A., Danfoss was fully intact and the situation was utilized to speed our efforts in the countries where we already were represented, and a great number of countries were soon covered by distributors or by our own branch offices. At the same time the production range was increased and now consists of two main groups, i.e. hermetic compressors and automatic controls for refrigeration plants, oil burners, water supply and compressed air as well as relays.

"The number of pieces of equipment leaving our factory at the moment amounts to approximately 15,000 daily and Danfoss export has, for instance, during the first three months of 1958 been 1.5 per cent. of the total Danish export or 4 per cent. of the total Danish export of industrial products."

Mr. Chr. Matthiesen, managing director of the technical department, said : "In our opinion, it is imperative that the customers are always able to get technical advice as to correct application of our controls. The technicians of our department are prepared, therefore, to pay visits to customers having problems of a technical nature, whether it is a matter of starting up a new plant or whether it is in case of sudden need at a plant already in operation.

"These visits take place in our own country as well as abroad and possibly together with a technician from the



Examining some of the Danfoss products displayed at the luncheon referred to above.



Danfoss branch office or agent concerned. Further, the technicians naturally are at disposal for the customers visiting the factory itself and this not least during the annual heating and refrigeration congresses.

"It may also be mentioned that the technical department often receives projects covering new plants or modernization of existing plants so that the staff act as consulting engineers by the final planning in respect to manner of operation and selection of the most suitable controls."

Mr. C. Kidde-Hansen, managing director of the production department, said: "High productivity is of greatest

importance for Danfoss to stay on the market, but higher productivity is also the only way to a higher standard of living for all of us.

"What has been achieved so far here at Danfoss, and what are we doing about this problem in the future?"



"M.R." Snapshots

Top left: Mr. M. F. Schøler and Mr. R. Friese.

Above: Mr. J. Mølgaard, Mr. R. Olsen and Mr. M. Ramlau-Hansen.

Left: Mr. J. Schmidt, Mr. R. Olsen, Mr. A. Larsen, Mr. O. Møller-Olsen, Mr. J. Mølgaard and Mr. M. Kondrup (secretary of the organizing committee, Xth International Congress of Refrigeration—Meat Research Station, Roskilde).



"In a factory like ours with mixed production it is difficult to find a measure of productivity, but light can be shed on this question by an example from our largest single production—the production of compressors—by comparing the figures from 1955 with the figures of to-day.

Compressor Department	1955	1958	Increase or decrease per cent.
Production per week ...	3,500	12,000	—
Number of compressors made per workman per week in the compressor department	10	30	200
Selling price in per cent. when 1955 is put at 100 ...	100	82	18
Average wages for workers on piece rate in the production	214	264	24

"As you can see both the customers and our workers have got their share of our rationalization profit.

"And what about the future? Well, in order to make headway, great investments are in some cases necessary. As an example I may mention that an order has been placed for a *Transferline*, costing about 1,000,000 kroner, which

will release 28 of 30 workers for other work and thus will have paid for itself in about three years."

Mr. T. Flindt, managing director of the building and maintenance department, said: "Our department can be divided into the following sections:—

Department for construction of new buildings.

Department for maintenance and supply of electricity, water, etc.

Department for welfare and public relation.

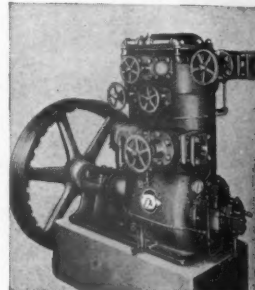
"Our construction department takes care of the construction of all new buildings here at the factory. The rapid expansion we have undergone and still are undergoing has of course meant that heavy demands are made on our construction department.

"To give you an impression of the size of our department I can mention that we employ approximately 50 technicians comprising architects, engineers, designers, foremen, subforemen, store keepers, etc., as well as approximately 350 workmen ranging from the carpenters erecting the first scaffolding to the masons, electricians, smiths, joiners to the painters making the last brush stroke."



COMMERCIAL AND INDUSTRIAL SECTION

Manufacturers' and distributors' news



We learn that **G. Williams Engineering Ltd.** of Willesden are moving their operations to Thetford next spring. The L.C.C. is developing a large estate on the Newmarket Road there and a new factory on a two-acre site and housing for many of the personnel will be provided. Development of the Williams premises will proceed in three stages, starting with 16,000 sq. ft. and finishing with 48,000 sq. ft. (at present they occupy approximately 8,000 sq. ft.). It is hoped to retain a London office and perhaps an assembly bay at Willesden after the removal.

* * *

A new vacuum-forming machine, for making plastic interiors of various Lec refrigerators, has recently been installed at Bognor. In operation the plastic is first warmed by a huge battery of infra-red heaters. The sheet is then clamped on to a frame and the

heaters move directly overhead. Next, the control governing the automatic cycle is switched on, and, at the end of a further period of more intensive heating which is controlled by an automatic timer, the heater returns to a neutral position. The manufacturing cycle then begins. This consists of the injection of hot air to the underside of the plastic sheet which rapidly assumes the shape of a huge blister. The mould then rises into the blister and, immediately it reaches the end of its stroke, vacuum is applied and the sheet snugs itself around the mould assuming the shape required. After cooling, the vacuum is broken down by the injection of low pressure air. This also releases the component from the mould, which is then lowered into its original position, and another interior is complete. The whole operation only takes a few minutes. The machine, known as a *Vacumat*, is German in origin and was im-

ported by Lec at a cost of some £5,000.

* * *

The 28th Grocers' Exhibition at Belle Vue, Manchester, presented York Shipley Ltd., in co-operation with five of their north-country distributors, with an ideal opportunity to show their wide range of storage and display counters and cabinets direct to the trade. Besides exhibiting the longest refrigerated display counter at the show, the York stand was remarkable for including a fine range of refrigerating machinery. The display included frozen food storage cabinets, the latest curved-glass display counter and the York Flake-Ice machine. To make their stand additionally attractive, York invited locally and nationally known users of their products to help dress the 80 sq. ft. of display area. The resulting colourful parade of cooked meats, fruit squashes and frozen foods was most satisfactory. The idea was supported still further by

Smedley's Ltd., who used two York display cases on their own stand. An exhibit that attracted much attention at the show was the largest Lancashire cheese in the world. The cheese, which weighed over half a ton, was made by Mark Procter Ltd. who have been users of York Equipment for many years.

* * *

Just completed at their Stag Lane, London, factory is a large new storage building for the **Frigidaire Division of General Motors Ltd.** 150 ft. long and nearly 230 ft. wide, the building—in five spans—is a Marley "G" type of precast reinforced concrete. It is completed with "super-six" asbestos cement sheeting to the roof slopes—which are 16 ft. high at the eaves—asbestos cement gutters to the flank walls, Marlith wood-wool valley gutters between the spans, and 10 78-ft. runs of patent glazing. The building will be used for the storage of finished Frigidaire products prior to despatch. Supplied and erected by Marley Concrete Ltd., Aveley, the main contractors were Jarvis & Sons Ltd., Vauxhall Bridge Road, S.W.1, and the architects, Howard Souster & Fairbairn, Piccadilly, W.1.

* * *

Since its introduction a year or two ago, **Edwards High Vacuum Ltd.**'s RD1 mobile refrigerator de-

They have proved particularly valuable to the service engineer on site because of their mobility. The RD1, however, was designed for domestic and shop refrigerators and small cold rooms; of course, for larger refrigeration systems it is essential that a bigger pump is fitted in order to handle the vapours and ensure fast pump down times. Edwards have, therefore, added two larger units to their range, the RD2 and RD3, both described in a new leaflet. The largest of the trio is the RD2 and this is fitted with a "Speedivac" ISC450 pump displacing 15 c.ft. a minute. A photograph of this pumping outfit is reproduced here and it will be seen that the equipment is mounted on a mobile baseplate and is also provided with a tubular framework to facilitate its movement. The RD2 outfit is approximately 34 in. long by 17 in. wide by 28 in. high and when fitted with a motor suitable for 3 phase A.C. supply the cost is £187 2s. 6d. All refrigerator dehydration units by Edwards are fitted with the new series of quiet running "Speedivac" pumps which is another useful feature when they are being used on site. These "silent running" properties have in no way affected the vacuum performance of these air ballast pumps which are designed to safely handle contaminating vapours.

* * *

British Cellophane Ltd. moved into new London offices this month. Their address is now Henrietta House, 9, Henrietta Place, London, W.1 (Telephone: MUSeum 8311). The building houses all BCL staff formerly in 12-13, Conduit Street and 20, Savile Row, W.1. London staff of Colodense Ltd. and Bonded Fibre Fabric Ltd., associated companies of BCL, are also moving to this address. The new offices will allow the company to extend and improve the services they offer. A demonstration room will be set up at Henrietta House.

* * *

At the thirty-first annual general meeting of **Matthew Hall & Co. Ltd.** held at Matthew Hall House, Dorset Square, London, the chairman, Mr. Bertram Baden, M.C., S.B.S.T.J., M.I.H.V.E., said, in part: "I am happy to report a consolidated trading profit for 1957 of £321,854 (1956—£314,739), despite

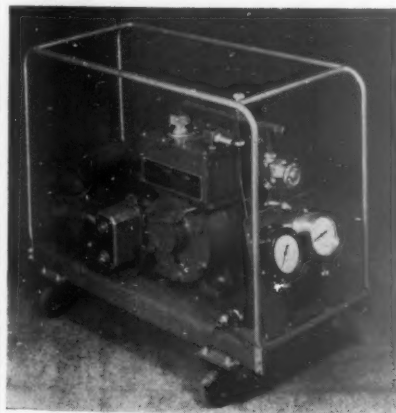
a reduction in the trading profit of our South African subsidiary company due to the keen competition I mentioned last year. . . . The group net profit after all charges, including taxation, was £99,319. . . . Among the important new air-conditioning projects were the new American Embassy office building in Grosvenor Square and a large windowless factory for manufacturing transistors. . . . Our multi-services contracts included air-conditioning, ventilation, heating, plumbing, electrical services and lifts for factories, laboratories and office blocks. . . . Our clients favour the advantages gained by placing all services with one firm. . . . During the year your company received orders for the installation of graphite moderators, instrumentation, fission product detection involving over 250 miles of stainless steel pipework, and other work at the new Central Electricity Generating Board nuclear power stations. . . . Our work at Calder Hall power station and other atomic research stations still continues."

* * *

The Hotpoint Electric Appliance Co. Ltd. announce that Miss Vera Stowell has been appointed chief housecraft adviser with effect from June 1. Miss Stowell joined the Hotpoint housecraft advisory staff at head office in April, 1956, with special responsibility for the expansion of their cold cookery activities. With her new appointment, Miss Stowell assumes responsibility for the company's policy and procedures in the whole field of home economics, including the functional control of a large force of demonstrator-saleswomen.

* * *

A new precoated steel sheet for vitreous enamelling is announced by **John Summers and Sons Ltd.**, of Shotton, Chester. Now in commercial production, it is the first development of its kind. Known as Nitec, it consists of an enamelling grade sheet-steel base, which is produced in a basic open-hearth furnace and is rolled by the continuous wide strip mill process. After annealing and cleaning, the sheet is subsequently coated with nickel and a protective coating of zinc. Costing approximately £8 per ton more than ordinary vitreous enamelling sheet steel, Nitec is



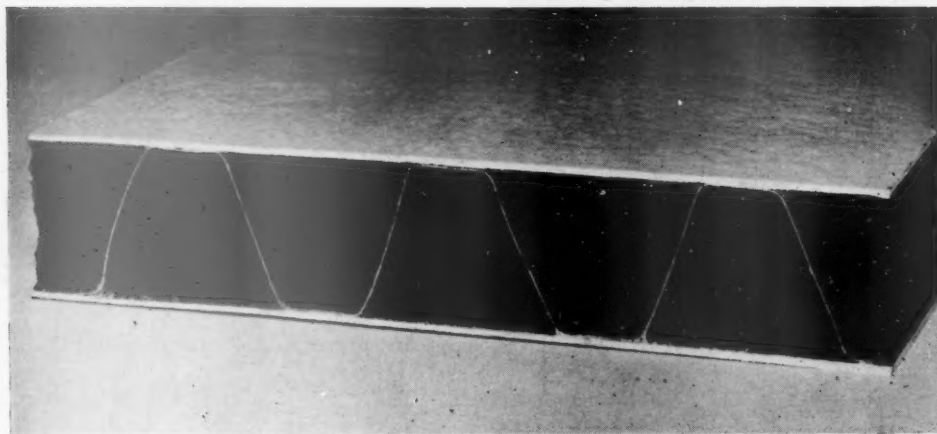
hydration unit has met with a considerable success in this field, and large numbers are now in use throughout this country and overseas, particularly in the Far East.

extremely economical, since it eliminates several stages in the vitreous enamelling process. Nitec need only be "pickled" for a period of three minutes, during which time the zinc coating will be removed and the steel degreased, saving many minutes in this operation. The removal of the zinc coating exposes the nickel flash ready for enamelling. It is important to note that no further operations are necessary, and that the duration times for the processes can be reduced. Further, Nitec gives a more consistent finish than has been possible hitherto, and reduces the number of rejects. Adhesion is better and more reliable and it is possible to have a more consistent surface. One development which is of great importance is in the single-coat finish, which obviates the necessity for a ground coat. Tests already carried out have shown that a "self-mottled" coat can be applied directly to the sheet.

* * *

The accompanying illustration shows a composite board produced by **The Byalex Paper Co. Ltd.** of Swanley, Kent; it is of a type used extensively in America for custom-built refrigerators. The main products of the factory are aircraft components made from glass fibre and polyester resins and such parts are, we learn, used in Hawker Hunter planes. Specification of the board includes the following characteristics:—

Weight per square foot
2.6 lb.



Water permeability

Practically nil.

Specific gravity

0.26 grammes per cubic centimetre.

Heat transmission coefficient

B.t.u. × in.

K 0.28

Ft. ² × h × °F

B.t.u.

K actual is 0.16

Ft. ² × h × °F

Fire Resistance

These boards have an approximate burning rate of less than 0.25 inches per minute.

Price for 2 in. boards

Two skin glass/polyester—17s. 6d. sq. ft.

One skin polystyrene and

One skin glass/polyester—13s. 0d. sq. ft.

Size

4 ft. × 2 ft. × 2 in.—sample.

6 ft. × 3 ft. × 2 in.—standard.

* * *

A new fastener, widely used in many industries in the U.S.A., is now being produced in the United Kingdom. Known as the **Avdel lockbolt**, it replaces conventional fasteners such as nuts and bolts or solid rivets used in the fabrication of metal structures with much faster fitting speeds. The lockbolt assembly consists of a headed bolt, the shank of which has a series of annular locking, breakneck and pullgrooves, and a locking collar. Lockbolts are set automatically by using a portable high-speed pneumatically operated pull-gun. In operation the lockbolt is inserted into a prepared hole and the locking collar placed over the

protruding bolt tail. The pull-gun is then applied, the jaws in its nose automatically gripping the pullgrooves on the bolt tail. The gun trigger is then actuated and an axial pull is exerted on the bolt. The reaction to this pull is taken against the locking collar by the swaging anvil of the pull-gun so that the work is clenched tightly together.

* * *

The wide popularity gained by water-ices during recent years has provided one of the most arresting examples of changing public taste within the last decade. It is also a classic commentary on the impact which can be achieved by modern, hygienic packaging methods incorporating aluminium foil. An indication of the soaring sales of water-ices is given by the latest Board of Trade figures which show that in 1951 their production was valued at £497,000; yet by 1954 this figure had almost doubled in a jump to £917,000. To-day's sophisticated versions of the water-ice are a far cry from the chopped-ice and lemon confections of years ago, yet fundamentally they are based on precisely the same principles of fruit-flavoured ice. There is little doubt, therefore, that hygienic packaging methods have made an important contribution to the huge success which water-ices have achieved. In particular, the adoption of foil has proved especially suitable because of its high standards of performance in connexion with: (i) hygiene. One of the principal suppliers of aluminium foil to the confectionery and ice cream trades is **Venesta Ltd.**, who are one of the

largest aluminium foil rollers in Europe. Commenting upon the use of foil in connexion with the growing popularity of water-ices, Mr. P. D. Hartland-Swann, Venesta's foil sales manager, says, "I am not surprised that such an increase should take place, for it is simply an example of what can happen when the correct methods of marketing and packaging are employed."

* * *

LIGHTFOOT REFRIGERATION COMPANY

INCREASED SALES

MR. KENNETH LIGHTFOOT'S STATEMENT

The SEVENTY-THIRD ANNUAL GENERAL MEETING of the Lightfoot Refrigeration Co. Ltd. was held on June 17 at the Piccadilly Hotel, Piccadilly, London, W., Mr. KENNETH LIGHTFOOT, O.B.E., chairman of the company, presiding.

The following are extracts from his statement for the year ended December 31, 1957 :—

" During the year 1957 increased sales of our refrigerating machinery and the manufacture of a greater proportion of this in our own works together resulted in an increase in the profit earned by the engineering business of the parent company. The cold storage side of our business also had a good year and showed a substantially greater profit than in the previous year.

Increased Profit

" From the consolidated profit and loss account it will be observed that the total profit, before taxation, amounted to £105,639, as compared with £47,032 a year ago.

" In deciding to recommend that the dividend for the year should be at the rate of 8 per cent. on both the Preference and the Ordinary shares, the board has paid due attention to the policy of restraint asked for by the Government, to the incidence of taxation, and to the necessity of conserving our available resources for the expansion of our business and the development of our manufacturing capacity.

Record Orders

" The value of completed installations of refrigerating machinery invoiced during 1957 reached a record figure, showing an increase of 22 per cent. as compared with the preceding year. In addition to providing for this increase, the orders received during 1957 enabled us to commence the current year with a 15 per cent. greater value of unexecuted orders on hand than was the case a year ago.

" The installation of additional machine tools, together with new designs of certain essential parts of our equipment, enabled us to manufacture many of those parts of our plant which up till now we have obtained from outside suppliers, and this resulted in a reduction in our overall manufacturing costs.

Additional Factory Space

" Following on this increase in production, every square foot of our works' area was fully employed and shortage of working space involved us in undue expense for transport and storage of material awaiting delivery to our customers. During the current year we have been successful in negotiating a long lease for additional factory space immediately adjoining our existing premises. This will increase our productive area by approximately 50 per cent. and enable us to extend still further our policy of manufacturing in our own works the greatest possible amount of the material required for our complete refrigerating plants.

Expansion of Cold Stores Company

" The first operating year of our cold stores company was one of modernization and expansion, the benefit of which was not felt until the latter part of the year, and then only to a limited extent. At Southampton a completely new low-temperature store, capable of holding 700 tons of Frozen Foods at temperatures down to 20 degrees below zero, Fahr., was put into operation in July. At Hastings fully automatic refrigerating plant was installed and the old ice tank room converted into a meat sales depot complete with its own cold room for frozen meat. At Bedford additional storage space was provided for home-produced cheese, and a start has been made on the modernization and extension of the cold stores at Aldershot and Tunbridge Wells.

" The demand for cold storage was exceptionally good throughout the year and a satisfactory feature was the increasing use that is being made of cold storage for commodities produced in this country.

The Current Year

" The volume of orders which we have received for our refrigerating plant during the first four months of the current year has continued at a satisfactory level, and this year should benefit fully from the machine tools and plant installed during 1957 and from the additional factory space acquired this year to which I have referred. Provided, therefore, that no unforeseen circumstances arise to interfere with the normal flow of business, either in this country or internationally, there is every indication that the current year will produce results that will be considered satisfactory."

The report and accounts were adopted.



The accompanying photograph shows a part of **Crawley Brothers Ltd.**'s stand in the British Industries Pavilion at the World Exhibition in Brussels. Included in the display are two examples of the "ACRO-KOOL" iced drink dispenser while

certain types of water cooler may also be seen. The display is arousing very great interest indeed and although the exhibition is not, of course, a trade fair nevertheless very many business enquiries—and orders—are being received.

An attractively-produced new 50-page loose-leaf catalogue has been issued by the **Magnetic Valve Co. Ltd.** Printed in three colours on heavy gloss paper, with nearly 100 photographs and line drawings, it gives information on the company's products and services. Full details of standard-type MVC magnetic valves are given, together with information on valves available for special applications. Other pages deal with ancillary equipment, including MVC rectifier sets, thermostats, electro-thermal links, pipe strainers, magnetic control switches and engine emergency cut-out switches. Three pages are devoted to general data on magnetic valve installation and service. Useful charts and conversion tables are also included. These are also available as single-sided indi-

vidual charts. This section of the catalogue comprises a viscosity conversion table; a viscosity/temperature chart for fuel oils; a Centigrade and Fahrenheit conversion table; a steam temperature chart; circle area and circumference charts; and tables of decimal equivalents to inch-fractions, water boiling points at various pressures and heads of water and equivalent pressures. Copies are available from 28, St. James's Place, London, S.W.1, quoting reference MVC 31.

In addition to their well-known LD (3½ h.p. and 7 h.p.) and SL (4½ h.p., 8½ h.p. and 12½ h.p.) air-cooled diesel engines, **R. A. Lister & Co. Ltd.**, of Dursley, now manufacture a new range as two- and three-cylinder models, rated at 20

h.p. at 1,800 r.p.m. for the twin-cylinder version and at 30 h.p. at the same speed for the three-cylinder engine. The engines can be provided with alternative speeds and power outputs. This series of engines is a direct development of the present smaller air-cooled diesel engines of 3½ h.p. and 7 h.p. The new engines have inherited many of the characteristics of their predecessors, notably simplicity of design, exceptionally good starting, a most economic fuel consumption and reliability. Direct injection for the fuel is provided by an injector of a patented design in conjunction with a unique combustion chamber in the piston crown. These air-cooled engines form convenient and readily adaptable power units suitable for a wide sphere of industrial, agricultural and marine applications under all conditions of climate and temperature.



R. A. Lister & Co. Ltd. S.L. three cylinder, air-cooled engine of 12½ h.p. at 1,800 r.p.m.

Lec Refrigeration Ltd. announce the addition of a refrigerated counter-top display, model CD6, to their range of commercial cabinets. The CD6 is entirely self-contained. It is equipped with a space-saving condensing unit, hermetically sealed and bearing the usual Lec five-year guarantee. This is compactly housed at one end in a small compartment which has an attractive blue "Ware-rite" top providing a useful area for a display or till. There is an illuminated sign at the front of this

compartment. A further "Ware-rite" covered area 6½ in. wide runs the length of the counter-top at the rear (and above the finned coil) to facilitate the wrapping of goods sold from the cabinet. Price, including installation and service fee, is £128.

* * *

For a star salesman of a frozen food organization there could be many suitable prizes, but what could be more appropriate than a refrigerator! At the Woking show-rooms of Prestcold distributors, Hampshire Refrigeration Ltd. recently, the winner of a Birds Eye regional sales competition had his award—a Prestcold "big-four" domestic refrigerator. The lucky recipient was Mr. R. E. Smith and the presentation was made by Mr. F. L. Parry, sales operations manager of Birds Eye Foods.



GREENFORD ICE CREAM PLANT

(continued from page 682)

buildings were permitted but there was no time to wait for the walls to go up before starting work on the insulated interior. Smiths Insulations Ltd. were called in to help with the solution of this problem. This firm specializes in the design and construction of cold stores, using prefabricated sections which are delivered to the site, placed in position and bolted together.

Work was started at Greenford on the first two of the three despatch cold stores in the autumn of 1955 in exceptionally bad weather conditions which made the contractor's task particularly difficult.

Each of the two stores has an area of about 6,400 sq. ft. The prefabricated sections consist of panels 15 ft. high by 4 ft. wide.

However perfectly a cold store is insulated, a certain amount of water vapour is bound to find its way through the vapour seal and into the insulating material. In the case of walls and ceilings, this may not be of great importance but special measures have been taken to protect the insulation of the floors from becoming ice-bound.

The Minikay system has been built into the floors of the cold stores at Bridge Park.

The new technical service laboratory of I.C.I. Paints Division at Slough is the most outstanding of its kind in the country, and possibly in the world. The service departments—pretreatment, industrial, motor manufacturers and refinish, commercial transport, woodfinish, decorative and marine—are housed in one building, together with oven room, trainee sections and lecture hall, equipped for the showing of training films.

At Bridge Park the Minikay system is also used to protect the insulation of the hardening tunnels of the "Zippy" and "Brick" plants. Grooved heavy density cork slabs have been built in under the floors of the tunnels, while the walls and ceilings contain slabs of normal density grooved cork. Dried air is circulated through the grooves at intervals to draw off all the accumulated water vapour.

Contractors

Main Contractor—G. Percy Trentham Ltd.

Processing Plant—A.P.V. Co. Ltd.

Refrigeration Plant—York Shipley Ltd.

Cooling Towers—Film Cooling Towers Ltd.

Water Pumps—Frederick A. Pullen & Co. Ltd.

Powered-operated Valves—Saunders Valve Co. Ltd.

Factory Cold Stores—C. Hemmings & Co. Ltd.

Despatch Cold Stores—Smiths Insulations Ltd.

Cold Store Protection—Minikay Ltd.

Cold Store Floors—E. J. Elgood Ltd.

Freezers—Clarke-Built Ltd.

Low Temperature Insulation—Onazote Insulation Co. Ltd.

Control Panels—Elliott Bros. (London) Ltd.

Electronic Recording and Counting—Londex Ltd.



A posy kept fresh in the refrigerator was presented to Lady Nelson (left) during the president's tour of the 1958 British Electrical Power Convention Exhibition by Mrs. H. C. Timewell on The English Electric Company's stand (see also page 690).

Heenan & Froude Ltd., of Worcester, are to supply more than 120 Heenan tubular air coolers to the English Electric Company Ltd., for use in the American Priest Rapids Dam. The coolers will be used for the closed circuit ventilation and cooling of the 10 vertical-shaft water-turbine alternators—12 coolers to each alternator. Two additional coolers will be supplied as reserves. Heenan & Froude have also secured a further contract from the English Electric Company for the supply of specially designed tubular coolers for the lubricating oil of the main thrust blocks of these sets. The main Priest Rapids contract, obtained by the English Electric Company despite severe American and other competition, covers the manufacture of hydro-electric plant which is the largest of its kind ever produced in the United Kingdom.

* * *

A most interesting publication on the automatic operation of a heat pump system has been issued by Ranco Incorporated of Columbus, Ohio. Believing that, to date, nothing has held up heat pump success more than the lack of reliable, automatic controls, Ranco discuss the application of their automatic de-icer control, slide type reversing valve and their automatic cycling control.

Many coloured diagrams help an understanding of this fast-developing branch of refrigeration.

* * *

Mr. L. L. Amesbury, managing director, Frostaire Refrigeration Co. Ltd., certainly does not believe in letting the grass grow under his feet. Having learned that Sabrina was officially opening the Hornsey Fair at the Grove, Alexandra Place, on Saturday, June 7, and was arriving by helicopter, with a little luck and co-operation of B.E.A. he managed to obtain a seat in the same helicopter. His reason for doing this was to present Sabrina with an invitation to visit stand 66B where they were exhibiting at the Grocery, Provisions and Self Service Exhibition at the new Royal Horticultural Hall at Westminster, which she accepted. The exhibition was from June 9 to 12 and showing on Stand 66B was a Marco Marquis low temperature cabinet, a Majestic 6 ft. fully illuminated display cabinet, a 6 ft. Marco Working display counter also a 6 ft. Marco window type display. There was also a sectional model of the famous Marco Serviseal unit. We understand that Frostaire do not now hold a Marco franchise.



The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENTRAL 4694)

FULL-TIME COURSES IN REFRIGERATION, 1958-9

ENROLMENT for the full-time courses in refrigeration at the National College for Heating, Ventilating, Refrigeration and Fan Engineering, Borough Polytechnic, Borough Road, London, S.E.1, is now in progress. Applications should be submitted without delay to the clerk of the governors of the College, from whom forms of application and syllabus booklets may be obtained. The courses commence on September 22, 1958, and end on July 10, 1959.

Institute members will remember that these courses were established in order to meet the needs of the industry by providing the necessary specialized educational facilities in refrigeration and allied subjects. The supply of trained refrigerating engineers in the future depends on full use being made of these facilities and it is, therefore, sincerely hoped that those members of the Institute concerned with staff training will release as many suitably qualified younger members of their staffs as possible for the period of the course. The advantages which will ultimately accrue to the industry by firms being far-sighted enough to release young men to attend these National College courses, at a stage when they most readily absorb knowledge, will be obvious to those with the interests of the industry at heart. The fees for the courses are very moderate and, in many cases, may be covered by grants or scholarships.

Diploma Courses in Refrigeration

The diploma courses are primarily intended for apprentices who have already qualified for their ordinary national certificate in mechanical engineering (including applied heat or heat and heat engines), which will have required three years of part-time day or evening class study at a technical college. The majority of students have this background and are released by their employers for the diploma course. Applications for admission to the diploma courses will also be considered from students with other qualifications if these are equivalent to the ordinary national certificate in mechanical engineering.

The British Refrigeration Association which, like

the Institute, has representatives on the board of governors of the College, actively co-operates with the College in assisting and encouraging member firms to release students to attend the College.

In certain cases, students attending diploma courses may obtain Government or county council grants and scholarships towards fees and maintenance during the necessary period.

Diploma Course in Air-conditioning and Refrigeration

This course is intended to meet the needs of those who are concerned with all aspects of cooling applicable to air-conditioning, and hardly at all with heating.

It is likely to be especially useful to overseas students from warm countries and to British engineers whose work may be predominantly concerned with hot climates.

Associateship Courses

The course of study laid down for candidates for the associateship of the College consists partly of advanced instruction in one of the three technologies catered for at the College and partly of training in research. About half of the available time is allocated to research, which may take the form of theoretical or experimental studies or the development of new designs. The candidate is expected to submit a thesis describing his researches which should show his ability to contribute to new knowledge. He will also be required to show satisfactory progress in his class work.

Deferment from National Service

Following negotiations between the Institute and the Ministry of Labour and National Service, in co-operation with the British Refrigeration Association and the National College, there is usually no difficulty in obtaining deferment for students, released for one year from the industry, provided that they are studying to obtain a recognized professional qualification. Candidates who are successful in the diploma examination in refrigeration satisfy the examination requirements of the Institute and thus the conditions for deferment are usually met. Students are, however, advised to join the Institute as student members, and the

Secretary will be glad to advise in particular cases.

Fees

The College fees for diploma and associateship courses, applicable to United Kingdom residents, are £50 and £60 per annum respectively, in addition to which there are small charges for College membership and as laboratory deposits.

College Hostel

An additional facility available is the National College hostel at Dulwich. Accommodation is provided at moderate charges, and applications for residence should be made at the same time as enrolment for the course.

Syllabuses

Full details of the subjects covered are given in the College syllabus booklet, referred to above.

GLOSSARY ON VACUUM TECHNOLOGY

In any rapidly growing branch of technology there is need for guidance in the use of approved terms and their concepts. The purpose of this new British Standard glossary is to define the terms of accepted value in the many branches of science and industry where high vacuum technology has become important.

The glossary differs in detail from its "opposite number" in the U.S.A. but every endeavour has been made to ensure that as far as possible the same term is used with the same meaning in the two countries.

SCOTTISH COLD STORAGE ASSOCIATION

(see also page 696)

In his annual report Mr. W. A. P. Milne said that there was an increase in the quantity of ice sold in fishing ports in both the east and the west of Scotland during the past year but they all viewed with some uncertainty, and perhaps a little anxiety, the many varied proposals for increase of territorial waters. It might well be that the loss of valuable fishing waters would adversely affect landings at some ports.

"A welcome and interesting development is the amalgamation of the Bon-Accord Ice & Cold Storage Co. Ltd. and North Eastern Ice Co. Ltd. under the title of Aberdeen Ice Co. Ltd., and we congratulate both companies on the successful outcome of long negotiations. It has been suggested that one of the purposes was to save a subscription to this Association, but I doubt that—even in Aberdeen!" said Mr. Milne.

"Dare I suggest that such a merger was originally made possible by the friendliness which this Association has done so much to create. We wish the new company well, and trust that it will have a long and prosperous history."

"The cold storage position has been in the main similar to last year, and your committee are of the opinion that conditions have reached a fairly static state with a surplus of space over demand in the importing areas, and a demand sometimes in excess of space available, in those areas where home produce is available for freezing."

"Once again butter was an important factor at the port stores, and there was a reasonable use of chilled space, with shell eggs very late due to the price remaining high, well past Easter."

"There has been a disappointing response to the British Egg Marketing Board's invitation to processors to break out and freeze eggs, but it is hoped that this will prove attractive to processors in the future and result in increased through-put for cold stores. I, myself, have visited one processor in Northern Ireland with a through-put of 250,000 eggs per day at the peak of the season."

"The new regulations for the freezing and storage of herring just issued by the Herring Industry Board, stress the growing importance of low-temperature storage space. To many people the demands made by the Herring Industry Board may seem unnecessary, but having 'paid the piper' they are entitled to 'call the tune.' As you know, they have the full backing of the D.S.I.R."

"The National Cold Stores (Management) Co. has once again had a successful year, not only as far as finance is concerned, but also in their work of keeping Government cold stores out of unfair competition with the industry."

"The national minimum wage agreement suffered its usual amendment with an increase to £8 6s. 10d. for the weekly minimum wage. A copy of the new memorandum was circulated to all members."

"Mr. Mackenzie and I had the good fortune to cross the Atlantic last autumn, and we took advantage of the chance to visit cold storage depots in several large cities. Unfortunately, time did not permit us to go out into the rural districts, where the most modern stores are being built. We were somewhat disappointed, from an educative point of view, in the visits which we made. The safety precautions were haphazard, cleanliness and neatness left much to be desired, and the engineering side appeared old-fashioned and not particularly efficient."

"On the handling of merchandise, however, there was much to be learned, and one store in New York particularly, appeared to work with less than half of the staff which one would have expected to find in a similar store over here."

"The increased cost of labour, and indeed the difficulty of finding good labour, makes mechanical handling a near necessity in any form of warehousing."

"We had a most interesting and illuminating visit to the Government Research Station in Ottawa, and found the experts there very much in favour of freezing poultry by brine immersion rather than by blast freezing."

"In past years, reference has been made to the preservation of foodstuffs by radiation."

"Experimental work has been progressing in this country and in the U.S.A. The most promising work done in Britain has been on the elimination of Salmonella from frozen whole egg, and on the pasteurization of chickens stored under refrigeration."

"In the U.S.A. they have now reached the stage of seeking legal permission from the Food and Drug Administration to market 'irradiated' foods, and it is thought that this permission may be forthcoming in the early 1960s."

"Should such permission be obtained, we may see some commercial activity along these lines in this country."

"I have heard it said that there is a resistance on the part of the British public to cold stored foods. I can well imagine what they will think of food subjected to radiation. None the less, it is a subject upon which we should keep a watchful eye."

"Once again, I offer my sincere thanks to all members of committee, to Mr. Finlay, and last, but not by any means least, to our secretary, Mr. Walker. In what has been for him a very busy year, he has found rather more time than usual to help me, and of course you, to keep the wheels moving in the direction in which we want them to go," concluded the chairman.

SHOP REFRIGERATION NEWS



The Individual Grocer

By Our Special Retail Correspondent

THE alternative adjective is *independent*. Both terms apply to grocers who own and operate one shop, or who may have turned themselves into limited companies with two or three branches. Conceivably the number could go up to nine (for, by general acceptance, it is 10 branches that start a multiple business); but, by then, the grocer, although retaining his independence and/or individuality has ceased to be small.

He is sometimes referred to as the private grocer, the one-shop man, the small trader, and although for more than 30 years we have been told that he has had it, owing to the growth of the multiples, he has continued to carry on under conditions which range from thriving to mediocre. But it is only comparatively recently that that threat of gradual erosion by the waves of big business, with its price-cutting competition, has brought about the construction of any kind of breakwater. It takes the form of group-buying and, since that includes shop equipment, it is a development affecting all suppliers of refrigerated cabinets.

In his presidential address to the annual conference of the National Federation of Grocers' and Provision Dealers' Associations, held at Hastings recently, Mr. Leslie Mower said: "Statistics

show that the independent retailer has not been obtaining his full share of the increasing trade during the last few years: this has alarmed our wholesale friends, for, unless they have their own retail outlets, their future is the same as ours. Many of them are offering increased services of considerable help, appreciated and utilized by a growing number of members . . . *There is also practical help in fittings and equipment.*"

Then, by special invitation, Mr. Garfield Weston, the largest individual grocery wholesaler in the world, spoke to this gathering of grocers from all parts of Great Britain. "You 65,000 grocers of this country have a great responsibility on your shoulders," he said "You must keep down prices and the cost of living *by uniting* to make yourselves competitive." He said he was ready, if the Federation wanted it, to produce a pilot scheme that would save the small grocer. A member asked whether that scheme would *help him to equip his shop* and was told by the president of the Federation that finance would be provided.

Meanwhile, under the auspices of wholesale firms in different parts of the country, buying-groups have been established. At the time of writing, there are 90 of them associated with 4,000



Installation at Evershed's, Shoreham-by-Sea.

grocers' shops. Some of them are connected with associations and others are formed by individual wholesalers. One such organization, Spar

(Britain), Ltd., prefers to be described as a selling group, because in conjunction with an individual wholesaler in each district, it concentrates on selling conditions. Spar gives particular attention to refrigeration, and it is a considered part of its policy to recommend cabinets of only the highest standard type. Referring to the activities of this organization in a recent leading article, *The Grocers' Gazette* says: "... the SPAR shops are bright, modern, and as attractive as any multiple ... The improvements are the direct result of an intensive personal effort by the wholesalers and retailers working together, inspired by the idea of latter day food retailing—charm, efficiency, and economy, which add up in turn to mutual prosperity."

In a talk at the Self Service Development Association's conference, which also took place last month, Mr. H. D. Love, director of the Alliance of Individual Grocers, a group-buying organization sponsored by Peter Keevil & Sons, Ltd., wholesale grocers, said: "The outstanding characteristic of voluntary group trading is that the emphasis is upon improving the sales effectiveness of the retail shops."

How does all this affect refrigeration in the grocers' shops? The parts I have italicized should I think make it clear that these voluntary group developments are of profound importance to the makers of refrigerated cabinets, because they are making it easier for the individual grocer to buy them and some of them are encouraging him to buy only the best. Some of these groups have their own shop-planning sections,

Mr. Taylor's fine layout at Redhill.



MOULDED IN LUSTREX

*Refrigerator butter dishes moulded in Lustrex by Fraser & Glass Limited
for the Pressed Steel Company Limited*



Lustrex polystyrene has grades for every purpose: for toughness—and extra-toughness . . . Lustrex Toughened 3 and Toughened 11 • for vacuum-forming—Lustrex Toughened 6 for sheet extrusion • for intricate mouldings—especially those needing a long flow . . . Lustrex Hi-Flow 55 • for dry colouring—to any shade you require . . . Lustrex Colourant Blend • for almost any job in polystyrene . . . Lustrex General Purpose. *Lustrex is a Registered Trade Mark.*

We also welcome your enquiries for the following imported product which is manufactured by Monsanto Chemical Company, U.S.A.

Santocel A for Thermal Insulation.

1. *High Thermal Efficiency*—K Factor (mean temp. 60 F.) 0.150 BTU/Hr./ft.²/in./F.
2. *Free Flowing Properties*—simplifies the filling of irregular spaces.
3. *Versatile*—saves space and is ideal for both high and low temperature work.



Regd.

MONSANTO CHEMICALS LIMITED, Plastics Division,

355 Monsanto House, Victoria St., London, S.W.1 and at Royal Exchange, Manchester, 2.

In association with: Monsanto Chemical Company, St. Louis, U.S.A. Monsanto Canada Limited, Montreal. Monsanto Chemicals (Australia) Ltd., Melbourne. Monsanto Chemicals of India Private Ltd., Bombay. Representatives in the world's principal cities.



This small shop has recently converted to self-service and makes good use of two cabinets.

advising on the selection of equipment, and sometimes proving financial assistance.

One other development—a highly controversial one—is the introduction of hiring facilities. Apart from the refrigeration equipment suppliers who offer a hiring service, there are a number of wholesale grocers who encourage the installation of cabinets—more particularly those of the low-temperature variety for quick-frozen foods—by including a rental scheme as part of their special services. One example is provided by the firm of J. Evershed & Co., Ltd., of Shoreham-by-Sea, who have formed what is known as a Family Grocer Alliance, which, in addition to offering the individual grocer, services and discounts similar to those available to the multiple companies and Co-operative Societies, have organized a rental service of cabinets for either quick-frozen foods or the ordinary perishable products, such as dairy goods, cooked foods, delicatessen. These are generally Kelvinators of either 9·7 or 7 c.ft. capacity; but there are others available.

An unusually interesting example of the services provided by a buying group is the new grocery service shop opened in Station Road, Redhill, by Mr. G. E. Taylor, a fruiterer of that town. Mr. Taylor knew nothing about grocery but, by joining the Alliance of Individual Grocers, one of the voluntary groups already mentioned, he was able under the guidance of that company's retail sales development executive, to obtain a fully comprehensive stock of grocery and provisions. The group

also supplied him with the materials for the shelving and gondola, and the refrigeration equipment



The family business of Knight's of Kingstanding has also swung over to self-service.



Another view of the Kingstanding establishment.

was supplied in conjunction with G.D.S. Rentals, Ltd., by L. E. Clifford, Ltd., of Ewell, Surrey.

The quick-frozen food cabinet occupies a prominent position crosswise to the depth of the shop, and a three-decker cabinet for provisions and dairy produce occupies a central position on the right-hand wall.

But, although I have given primary attention to the ways and means of salvation for the individual grocer it must not be assumed that they are all in need of salvation. Some shops are so placed that they are not affected by multiple, supermarket, or any kind of cut-price competition. Some are still doing very nicely, thank you, in spite of it.

Of those that are seemingly free from either the threat or the arrival of cut-price multiple, or supermarket competition, a small majority have gone over to self-service, and the tendency continues in that direction.

In the very small village of Thundersley in Essex, Mr. R.L. Chance has just converted his shop to self-service, and the equipment includes two York Shipley cabinets: one for quick-frozen foods and the other for provisions.

Another example of conversion comes from an extremely contrasting district. Typical in many respects of the more progressive type of family grocer's premises transformed in this way is the shop of Knights of Kingstanding, Ltd., a family grocers in both senses of the term, for it caters for family trade and is run by a family. Started 37 years ago by Mr. W. J. Knight, and later formed into a company, with Mr. Knight, his wife, and two sons as directors, this shop is at 661, King-

standing Road, Birmingham. It has three Hussmann cabinets: a 6-ft. long double-deck model for fats, a 6-ft. long ordinary open-topped type for provisions, and a 7-ft. long model for quick-frozen foods.

(to be continued)

Frozen foods are featured in this Hall Green shop.



A PREPACKAGING DEVELOPMENT

IF the advent of self-service represents the greatest single revolution in food retailing since the war, many of the processes which came in its train can claim to be minor revolutions in themselves.

Perhaps one of the most important of these is prepackaging which, like self-service itself, has grown from small beginnings to national proportions. Developments in this field have tended hitherto to be concentrated on the wholesale or retail level with particular reference, as far as such

limited amount for direct supply to self-service stores.

The output at the moment is 3,000 packs a day, but the conveyor system for producing this amount is quite comprehensive and certainly adequate for a considerable future increase.

One of the principal pieces of equipment used in the process is a specially constructed Frigidaire service cabinet which has been installed by Howards Refrigeration Ltd., of Luton. The cabinet has a total capacity of 290 c.ft. and has been designed with interior shelving accessible through six locker doors.

Here the middles of bacon are held after boning at 32° F., for a period of approximately 24 hours. After this storage period the bacon is brought out for slicing. It has been found that not only does it slice more effectively when cooled but—and this

The refrigerated bacon is sliced and shingled and weighed in $\frac{1}{2}$ lb. lots.



commodities as fresh and cooked meats are concerned, to the preparation rooms of the retail supermarket stores.

In recent months, however, the growth of prepackaging has spread its tentacles one step farther along the line to the producer or manufacturer. Although on the face of it this may appear a logical development its adoption presents certain problems, and it is for this reason that the number of manufacturers at present engaged in prepackaging perishable commodities remains comparatively low.

One of those who have overcome the difficulties inherent in this form of food marketing is the Letchworth Bacon Company Ltd., who, having slaughtered and cured pigs for bulk bacon supply for many years, have now started to prepack a

is significant—it reduces wastage by as much as 50 per cent. In fact, loss through shrinkage and trimming in the first day the cabinet was in operation was reduced from 160 lb. to 80 lb.

The need for firmness brought about by refrigeration is also desirable in the slicing and shingling process, the second in the conveyor system.

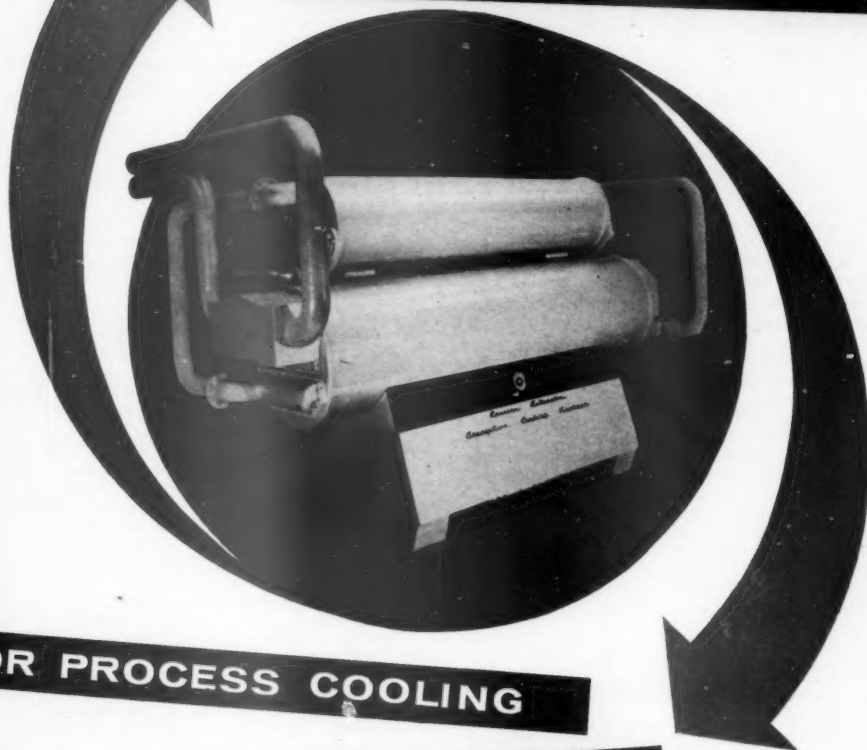
Here on a dual purpose machine the bacon is sliced in $\frac{1}{4}$ -in. slices, shingled in groups of eight and passed along a belt for weighing in $\frac{1}{2}$ -lb. lots.

At the end of the line the bacon is placed in packs, the packs vacuum drawn and in the same process heat-sealed.

To ensure safe and speedy retailing each packet is date-stamped on sealing and marked for consumption within 14 days of packing.

THIS supplies

CHILLED WATER



FOR PROCESS COOLING

FOR AIR CONDITIONING

*using low pressure steam from existing heating boilers
or other hot fluid*

The Carrier Automatic Absorption Refrigerating Machine is a highly economical unit that provides a constant supply of chilled water for process cooling or air conditioning, where steam or other suitable high temperature fluid

is available. Fully patented in Great Britain and all principal countries. There is a wide range of machines available to suit any load requirement. Ask today for complete details.

Carrier

Automatic Absorption
REFRIGERATING MACHINE

CARRIER ENGINEERING COMPANY LTD. 24 BUCKINGHAM GATE, WESTMINSTER, S.W.1. VICTORIA 6858

MODERN REFRIGERATION July 1958

725

Babbitt-insert rings have been used by some designers in recent years, and, together with honed cylinder walls, give a better sliding action than iron against iron. A machine is broken-in more rapidly in this way, while for higher piston speeds, bronze-inserted rings prove most effective in the absence of oxygen. This, however, more relates to ammonia than "Freon" machines, as the oil protects the bronze. When inserting or removing a piston, the ring guide provided with the machine should always be used to avoid breakage. In opening the ring to slip it over the piston, it should not be twisted, as it might become so distorted that it might never again maintain a seal along the sides. Any lateral warping ruins the effectiveness of the ring, since the sides do not have any sliding action to help to wear a tight seat.

Europe's most Modern, Hygienic and Complete Bacon Factory

Famous for their pork pies for more than a century, M. Bywater & Co. Ltd. opened recently what is claimed to be Europe's most up-to-date pig processing plant.

M. BYWATER & Co. Ltd., of Small Heath Birmingham have been famous in the Midlands for more than 195 years by reason of their pork pies. And now this old and famous company has launched a progressive plan of development that—eventually—will enable the firm to treble the production of their popular pies, sausages, and bacon.

The latest stage of development has been to open a bacon factory that many believe to be modern beyond comparison this side of the Atlantic. This extension to their Small Heath premises occupies an area of 12,800 sq. ft. and has cost £150,000. The factory is the first to conform with amended regulations under a Government-sponsored Bill which was considered in report stage by the Commons on April 23. The company has therefore been far-sighted enough to anticipate legislation and the factory will be ready to operate as soon as the Bill has been passed into law.

The most humane method of slaughter—anaesthesia by carbon dioxide gas—is used, and by this method the pig is completely relaxed for slaughter thus enabling a side of bacon to be produced from a pig with no muscle tension impossible under electrical anaesthetization.

Immediately after the carcasses have been graded and inspected in accordance with Ministry regulations, they travel by conveyor to a pre-cooler where, under exact control of temperature and humidity, they are chilled to 59° F. Experience has shown that this cooling preserves the flavour and improves the appearance of the bacon. The carcasses remain overnight in an after-cooler.

Bywater's new factory can handle 120 pigs an hour. Fast mechanical handling and transportation expedite the chilling and processing.

In the bacon-trimming department dust-free conditioned air maintains a constant temperature of 45° F. From here the trimmed sides travel down a stainless steel chute to the curing cellar.

Every detail of technical or practical progress in food processing has been exploited to make sure that Bywater's LEENA brand English bacon is comparable with any produced in Britain or—for that matter—any other country in the world.

The opening of the factory was performed by Lt. Gen. Sir Archibald Nye who last October became the first chairman of the Pig Industry Development Board. Over 130 guests attended among whom were the deputy secretary of the Ministry of Agriculture, Fisheries and Food, and the vice-chairman of the National Farmers Union.

Book Review

Heat Transfer, vol. II, by the late Max Jakob. xxxii + 652 pp. including 320 figures, 63 tables, 1,519 equations, 51 problems. 9 in. x 6 in. John Wiley & Sons, Inc., New York, and Chapman & Hall, Ltd., London.

This is the concluding volume of the work of this doyen of heat transfer who died suddenly during the final checking of the text. The completion of the latter and the editing were carried out by Dr. Stothe Kezios.

The first volume was an international survey of the scientific concepts, fundamentals and basic analyses of heat transfer treated from mathematical and physical aspects.

The opening chapter of the present work is a continuation of volume I dealing with heat radiation in spaces, and a supplement of 40 pages brings up to date various chapters of volume I. The main portion of this book deals with selected fields of application, showing the way to practical usage of the scientific principles.

Separate chapters are devoted to temperature measurement, ordinary heat exchangers, regenerators, cooling towers, cooling by falling liquid films, cooling of surfaces exposed to hot gases, heat transfer through laminar and turbulent boundary layers, in liquid metals and in packed columns.

The author's last recorded comments appear to have been: "Better to present something which is not complete now, than the same thing complete, never."

Air-conditioning : Domestic and Export

" Explosive Growth in next Five Years "

From Our New York Correspondent

DESPITE a slump in new housing, the air-conditioning industry in the United States is full of optimism. Last year's sales showed good gains, and manufacturers of both room and central systems expect a favourable development. Or, as *Business Week* expressed it: "Projections for the next five years promise explosive growth."

There are three main factors for this optimism: (1) The industry is beginning to overcome the no. 1 problem for room units—their dependence on the weather and a short selling season.

(2) Technical improvements in both central and room units are resulting in quieter, smaller, better-looking, and more efficient products that are easier and less costly to install.

(3) The shakedowns on the manufacturing side in the past two years—again mainly in room units—promise greater stability in production and marketing.

4,000,000 Units a Year

This year the air-conditioning industry expects to sell about 2,000,000 room units, against some 1,600,000 last year. For "central residential" the expectation is about 250,000 units, against some 165,000 last year. Optimistic estimates put annual sales of room units at about 4,000,000 by 1965. Industry experts, according to *Business Week*, think total home air-conditioning sales last year came to about \$ 821,000,000 with room units, at around \$ 426,000,000, getting the lion's share. By 1962, experts are looking for something close to \$ 1,500,000,000.

Three years ago there were some 50 manufacturers turning out about 100 major brands plus many minor labels. To-day the field has dwindled to about 25 manufacturers and perhaps 50 different brands. In the central system business more companies are coming into the field. About seven companies entered the central system business this year, bringing the total to about 78.

General Electric estimates that the cost of central systems to the consumer dropped 50 to 60 per cent. between 1952 and this year. In the past three years the average room cooler has dropped about \$ 50; this year's models run around \$ 250 to 275.

It may well be years before the room unit loses its dependence on the thermometer. When it gets hot in June or July (or May), everyone wants to have an air-cooler. When the summer is cool, people wait and see. But there are signs of a basic change. In 1952, according to *Business Week*, only 6 per cent. of the industry's annual sales occurred in the first three and last three months of the year. Last year, this figure was up to 18 per cent.

Export of Air-conditioning Units

Exports of American air-conditioning units are rising sharply. They have increased during the last two years at a rate of 35 per cent. a year. Last year their value was a record exceeding \$ 60,000,000. This rate of increase is expected to be maintained for the next several years.

About 66 per cent. of exports are self-contained units, the balance are central systems. The United States has about 90 per cent. of world markets in the self-contained category, and about 75 per cent. in other kinds.

Where do those units go? In fact, they go everywhere, from Hong Kong to Baghdad, and from Canada to Switzerland. Paul C. Sharp assistant manager, of the Minneapolis-Honeywell Regulator Company, recently said that Cuba, Venezuela, Mexico, Saudi Arabia, India, Canada, Britain, Belgium and Switzerland are exceptionally promising air-conditioning markets. This statement shows that sales potentials are not limited to tropical countries.

Foreign textile industries, for example, find that "climate control" eliminates machinery stoppage caused by variations of temperature and humidity, according to a survey by Brendan M. Jones. They also find that worker efficiency and operational "life" of machinery are increased by air-conditioning.

The trend abroad seems to be toward more extensive, varied uses, although still not on as wide a scale as in the United States. Air-conditioning, on the other hand, is a "must" in modern tourist facilities in tropical and other areas, especially if they want to attract American travellers. Mr. Sharp predicts a fourfold sales increase in the next five years.

Mr. Jones mentions the fact that air-conditioning turns up in unexpected places, for instance, that native-hut job. The order was handled by a Carrier Corporation branch in British North Borneo. An oil company's night shift drillers, working at Brunei, found that daytime sleep in their hut was next to impossible because of heat and noise. Carrier sent an air-conditioner by helicopter, the hut was sealed up and air-cooled to the satisfaction of workers and management.

Engineers have learned that only about 75 per cent. of the cost of air-conditioning goes towards the actual cooling of a house. The other 25 per cent. goes to keep the house free of moisture.

In many houses the biggest single source of moisture is the automatic clothes drier, according to observations mentioned by J. M. Orr. This appliance literally blasts water vapour into the house unless it is vented outside. Engineers say the clothes drier should always have a short piece of stovepipe leading from its rear exhaust opening outdoors.

New Air-conditioners are Quite Different

Consumer's Union—a very important, non-profit organization which tests consumer goods of all sorts and size, from automobiles to toothpicks—recently has tested many brands of air-conditioners. In their report they stress the fact that the 1957 air-conditioners are quite different from their forebears which CU also tested in 1953. Not only have they undergone a reduction in their appetite for electric current, but most of them are noticeably smaller. Where a $\frac{3}{4}$ -h.p. air-conditioner was the largest size old-style air-conditioner practicable for the typical household—and then only if it was the only piece of electrical equipment on a line—the same wiring system can accommodate a 1-h.p. 1957 conditioner without strain, and without the special 230-volt installation needed for earlier models.

Furthermore, even with flush-mounting inside the room, the slimmest 1957 models will jut out no more than a foot or so beyond the window pane.

Do these streamlined, small-appetite conditioners do as good a cooling job as their predecessors?

Here is CU's answer. The new-type $\frac{3}{4}$ -h.p. conditioners, drawing about 60 per cent. as much electric power as the older type, provide about 85 per cent. as much cooling. The new-type, 1-h.p. models provide about 15 per cent. greater cooling than the older-type $\frac{3}{4}$ -h.p. models with just about the same drain of electric power.

Costs of Installing and Operating

Installation costs are likely to run no higher on the larger units unless special wiring is required, according to CU, but their operating costs are almost sure to be more. Operating for 10 hours a day, CU points out, with electricity 2 cts per kilowatt hour, a $\frac{3}{4}$ -h.p. unit would cost around \$ 5 a month to run; a 1-h.p. unit, around \$ 8. However, under most conditions of temperature and humidity, the compressor will probably average much less than 10 hours operation per day, and the cost will be correspondingly lower.

If there is a choice in the room to be cooled, CU recommends that the conditioner should be put on the shady side for better cooling. If you mount it in the sun, an awning installed to shade the conditioner is a worthwhile investment. Many home owners mount their air-conditioners directly in the wall of the house, rather than in a window. While such installation is more costly, it does provide a greater choice of location for improved appearance and efficiency. A mounting high on the wall is usually preferable.

It is not easy to say offhand what size air-conditioner a given room can use to advantage. Among considerations that enter, CU mentions the room's size, its orientation, the number of windows it has, the number of people who use it habitually, whether the conditioner is to be used during the day or only at night, the extremes as well as the usual run of temperature and humidity in the area where the house is situated, and others. "A conscientious dealer will make a survey of these factors and come up with the answer."

Supervisory Data Centres for Air-conditioning

Commercial buildings of all sizes, shapes and ages are having their temperatures taken electronically as part of a new approach to the maintenance of indoor climate-control systems for increased comfort of tenants. The process is an outgrowth of both automation and electronics, making use of a complex thermostatic network directed by a centrally located control panel, according to Earle Barker, commercial manager of the Minneapolis-Honeywell Regulator Company.

The control panels, known as supervisory data centres, provide for around-the-clock monitoring of indoor building temperatures and the instantaneous automatic adjustment of remotely placed control equipment to keep office temperatures at the precise levels requested by individual tenants.

In the past, supervision and control of air-conditioning plants of big buildings required large crews of skilled maintenance men. To find out if some parts of a building were too hot or too cold, an engineer either had to send a man to check it, or wait for complaints from the occupants. After a complaint, the maintenance man still had to check it and make adjustment.

Minneapolis-Honeywell estimates that one man will be able to perform the duties of three with the control system to be installed in a new Montreal hotel. The panel of this system, moreover, will be in full view from the hotel's lobby.

The practice of placing the control panels where the tenants and the public (in banks, hotels, large office buildings) may see them, is said to have found favour with architects. It is viewed as tangible evidence of the landlord's concern with the comfort of his tenants.

Normal Wiring for 1-Ton Air-conditioner

The first 1-ton room air-conditioner to operate on 7 $\frac{1}{2}$ ampere, 115-volt household electric wiring, was introduced recently by the Fedders-Quigan Corporation. Up to now, room units performing efficiently on this amount of current have been limited to $\frac{1}{2}$ -ton models. All 1-ton units have drawn 12 amperes, requiring special wiring in most cases.

The new air-conditioner will provide 35 per cent. more

cooling than 7 $\frac{1}{2}$ -ampere units of $\frac{1}{2}$ -ton capacity. The new unit has a cooling capacity of 9,000 B.t.u. All reputable room air-conditioner manufacturers this year are stating their cooling claims in terms of B.t.u. Former claims about cooling in terms of a room's sq. ft. content of 10 were not borne out because of different kinds of insulation and other factors bearing on the efficiency of a room air-conditioner. Generally speaking, former claims had a 1-ton unit cooling a 750 sq.-ft. room.

The new unit was attached to a clock radio, which turned the air conditioner on and off by means of the radio's timer. This is the first 1-ton unit that could be automatically controlled by a clock radio time which takes a maximum of 1,100 watts. Twelve-ampere, 1-ton units, according to Thomas Ford, Fedders engineer, take 1,200 watts and either blow a fuse or cause both radio and air-conditioning unit to stop immediately when joined.

IRRADIATION RESEARCH

Four leading U.S. firms in the food and allied industries—Armour & Co., Continental Can Co., Food Machinery & Chemical Corp. and General Food Corp.—have joined forces with the U.S. Army Quartermaster Corps in setting up the world's first food radiation centre, it was announced by the Defence Department. This U.S. Army Ionizing Radiation Centre (USAIRC), under a contract awarded by the Quartermaster Corps, will be built at Sharpe General Depot, Lathrop, California.

In a joint statement explaining their interest in supporting the project, the presidents of the four stockholder companies said:—

"We share the conviction that the irradiation of foods opens an important new frontier having significant possibilities not only for the Armed Forces, but for the civilian population as well." We believe that it is important in the national interest that the use of radiation in the handling, processing, packaging, and protecting of food be developed as rapidly as possible, as is proposed by the Quartermaster Corps. Furthermore, we believe that the skills of private industry should be made available for this purpose in co-operation with the Government.

"Because of our conviction as to the significance of this project and the propriety of private industry sharing its resources of personnel and experience with the Government to carry out the project, we are willing to detach skilled employees from the important work they are now doing for our own companies in order to make them available for employment by IPI."

It is anticipated that approximately 150 employees will be required to operate the centre during its first year. Employment in the second year is expected to reach 250.

REFRIGERATION PATENTS

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the Official *Journal of Patents*, and are published by permission of the Controller of H.M. Stationery Office.

APPLICATIONS RECEIVED

April 8—Carrier Engineering Co., Ltd., C11099, Air-conditioning systems; C11100, Air-conditioning systems; C11242, Absorption refrigeration systems. 10—Slade Developments Ltd., R. E. Slade, R. E., P11339, Ice production. 11—Commissariat a l'Energie Atomique, C11607, Gases refrigerating purification. 23—Dunham-Bush Ltd., C12951, Refrigeration system. 25—Unilever Ltd., Rawlings, F.E., P13272, Refrigerated cabinets. 29—White & Co., Ltd., J. S., Royle L., P13581, Ice cream machines. 30—Pressed Steel Co. Ltd., Longman, C. W., P13805, Refrigerators. May 1—V. D. M. Spinners Ltd., Barnes, N. J., Burton, P., and Ravenscroft, G. S., P13835, Refrigeration systems.

May 9—Eastwood Ltd., W. & J. B. Eastwood, J. B., P15315, Meat, etc., preservation process; Thermal Closures & Containers Ltd., Rogers, J. L., and Sales, D. A., P14924, Refrigeration of cold stores, etc. 12—Hall Ltd., J. & E., Bomford, J. F., and Robinson, E. C. S., P15105, Cooling apparatus. 16—Electrolux Ltd., C15777, Absorption refrigerating apparatus; Icecrafter (Liquidating) Trust, Bayston, J. R., and Kuebler, T. L., C15886, Ice-making machine. 19—Hotpoint Electric Appliance Co. Ltd., Baines, D. L., P16027, Refrigerator cabinets. 23—Frosty-Glass Co., C16616, Glass vessels refrigeration apparatus. 27—Veb Maschinenfabrik Nema. Ernst, S., C16847, Refrigeration machine, C16844, Cold-treatment plant.

COMPLETE SPECIFICATIONS ACCEPTED

April 23—General Motors Corporation, 796,587, Ice block release apparatus; 796,588, Freezer trays assemblies; 796,626, Refrigerator, Calumet & Hecla, Inc., 796,917, Refrigeration driers and methods of assembling such driers. 30—Brown, Boverie & Cie. Akt.-Ges., 797,212, freezing tray for the production of ice cubes in refrigerators; McGee, J. D., 797,225, refrigeration applicator. May 7—Parisi, R., 797,638, Apparatus for the freezing and delivery of portions of ice cream; Daimler-Benz Akt.-Ges., 797,336, Air-conditioning installations on motor vehicles. 14—Soc. Anon. des Usines Chausson, 798,005, Two-stage compressor, more particularly for refrigerating apparatus. 21—Svenska Turbinfabriks Aktiebolaget Ljungstrom, 798,290, Artificial ice rink.

May 29—Gregson & Co. Ltd. and Bishop, A. H., 798,417, Plug type doors; Morrison, W. L., 798,769, Chilling, storing and transport of foodstuffs and the like; Morrison, W. L., 798,770, Refrigeration systems; General Motors Corporation, 798,433, Ice-block release arrangements for tray-grid assemblies. June 4—Carrier Engineering Co. Ltd., 798,965, Systems and apparatus for heating and/or cooling an enclosure; General Electric Co. Ltd., 798,882, Thermoelectric cooling units. 11—Spalding, D. B., 799,143, Pressure-exchanger apparatus; Reynolds Metals Co., 799,463, Refrigeration compartment; Carrier Engineering Co. Ltd., 799,220, Purging arrangements for absorption refrigeration systems.

Modern Refrigeration is obtainable from the manager, Maclaren House, 131, Great Suffolk Street, London, S.E.1, at thirty-five shillings per annum, post free to any part of the world.

Mechanical Handling

SUCCESSIVE visits to the International Instruments, Electronics and Automation Exhibition and the Mechanical Handling Exhibition are apt to leave one with a robot mentality and a doubt whether one can walk down the street without remote control!

It was perhaps inevitable that someone would eventually combine powered conveyors with electronic control and selection. The result is little short of uncanny.

At the latter mentioned exhibition "the embryo automated warehouse of the future" shown by Manufacturers' Equipment Co. Ltd. of Hull.

This fantastic exhibit consists of an assembly of short powered conveyor units, working in conjunction with electronic selector heads to demonstrate how packages can be fed into a completely unmanned warehouse; weighed in the process (with the weights being teletyped in another part of the building) and directed along any number of conveyors to be ultimately stored away in the correct rack, even though that may be a quarter of a mile and five storeys away! Once cartons are fed onto the "inward" conveyor, everything is done by the equipment without any human intervention.

Even more fascinating is the way in which the same equipment can be operated by one man who may be out of sight of the warehouse proper, to despatch orders without handling or even seeing the cartons he is sending out . . . efficiently, quietly and quickly. All by pressing buttons!

The M.E.C. exhibit is, we understand, a considerable extension of deep-freeze installations already in existence in the U.S.A., where visits into

Girdlestone for PUMPS

Suppliers to the
leading refrigeration
plant manufacturers

Girdlestone
PUMPS LTD.

23 DAVIES ST., LONDON W.1.

Telephone: MAYfair 1354



Modern Refrigerated Ferry-boat Wagons for the
conveyance of your Perishables
from all over Europe



INTERFRIGO

**INTERNATIONAL
RAILWAY-OWNED
COMPANY
FOR
REFRIGERATED
TRANSPORT**

AGENTS IN GREAT BRITAIN—BRITISH RAILWAYS


—Continental Traffic & Shipping Manager, Eastern Region, Harwich House, 129 Bishopsgate, LONDON, E.C.2 Tel: B1Shopsgate 4702
—Continental Superintendent, Southern Region, Victoria Station, LONDON, S.W.1 Tel: WATERloo 5151

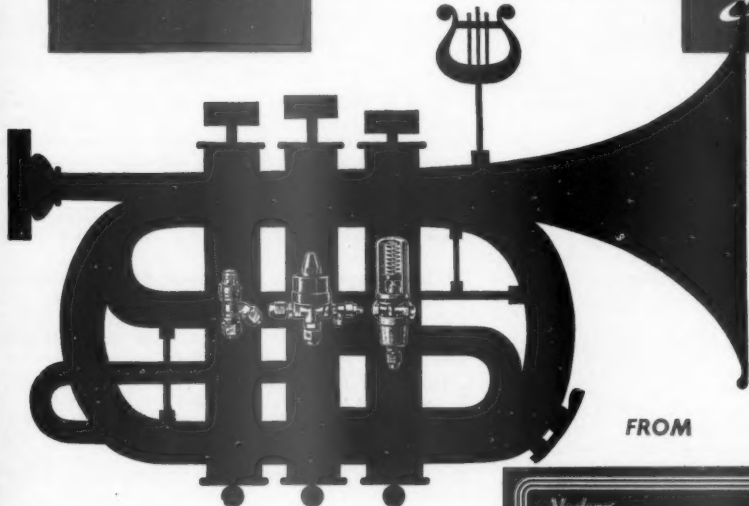
HEAD OFFICE :

HARDSTRASSE 52, BASLE, SWITZERLAND
Telephone : 41.18.74 Telex 6.2231

CONGRATULATIONS!

25th ANNIVERSARY





FROM

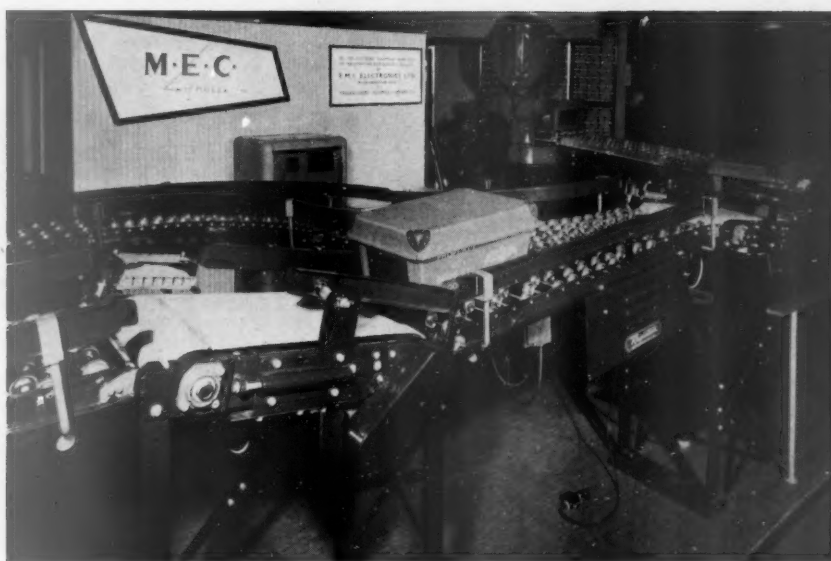
Modern

Refrigeration

MACLAREN HOUSE, 131 GT. SUFFOLK STREET

and best wishes
for the future—
thanks for good
and friendly
co-operation

LONDON, S.E.1



An exhibit indicating the possibilities of complete automation in handling frozen foods in and out of sub-zero stores.

the intensely cold warehouses are now infrequent. But M.E.C. have developed certain important

pieces of equipment which have never been used before—even in America!

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Pormor Ltd., 1, Wembley Avenue, Penwortham, near Preston. Secretary: D. Birchall, Preston. To carry on business of manufacturers of and dealers in refrigerators with the dual capacity of heating and cooling draught beer, and refrigerators generally, etc. Capital: £1,500. Directors: Frank Nicolson, 37, Newlands Avenue, Penwortham, near Preston; Joseph H. Webster, 94, Church Road, Tarleton, near Preston; Henry Hunter and Dennis Birchall. Solicitors: D. Birchall, Preston. Registered by Shaw & Sons Ltd.

Bennett & Lucas Ltd., 1, Cross Hill, Stoke, Plymouth. Secretary: R. G. Lucas. To carry on business of manufacturers of and dealers in ice cream and iced confections, etc. Capital: £1,000. Directors: Frank Bennett, 29, Brierley Crescent, Kings Tamerton, near Plymouth; Lewis J. James, Lower Road, Gunnislake, Cornwall; Raymond G. Lucas, 46, Clarence Place, Morice Town, Plymouth. Solicitors: Edwin Broad and Spencer, Devonport. Registered by Jordan & Sons Ltd.

Abbey Refrigeration & Electrical Co. Ltd., Duncan House, Lea Road, Waltham Abbey, Essex. Secretary: Mrs. J. Drake. Capital: £2,000. Directors: Mrs. J. Drake and Charles Deuchars, 46a, Lea Road, Waltham Abbey. Registered by Shaw & Sons Ltd.

Jersey Cream Ices Ltd., Estate House, 31, Dover Street, Piccadilly, London, W.1. Secretary: Joan Stone.

Nominal Capital: £2,000. Director: Doris Campbell, Twineham Grange, Bolney, Sussex (ch). Joan Stone, The Bungalow, Twineham Grange, Bolney, Sussex. Registered by Jordan & Sons Ltd.

C. & B. Mobile Services Ltd., Harefield House, Romsey. Secretary: Mrs. E. B. Smith. To carry on business of vendors, purchasers, manufacturers of and dealers in foodstuffs, provisions, including ice cream, etc. Nominal capital: £100. Directors: Clifford A. Collinge, The White House, Porton; Wallace F. Smith, Harefield House, Romsey; Mrs. Winifred M. Collinge and Mrs. Eileen B. Smith. Registered by Solicitors: Herbert Smith & Co., E.C.2.

Jeeves (Refrigeration & Electrical) Ltd., 24/5, Old Steine, Brighton. Secretary: A. V. Denyer. Nominal capital: £500. Directors: Clifford P. Jeeves and Mrs. Constance M. Jeeves, 24, New Church Road, Hove. Registered by Leonard Terry & Co., Brighton.

Harrison's Ice Cream Ltd. Nominal capital: £3,000. Directors: Elizabeth Harrison, "Freshfields," 231, Heckmondwike Road, Dewsbury; John Harrison, 346, Halifax Road, Hightown, Liversedge; Geoffrey Harrison, 24, School Lane, Dewsbury. Solicitors: Crosland, Jordan & Co., Mirfield. Registered by Solicitors' Law Stationery Society Ltd.

K. & F. (Private Stores) Ltd., 57, Charterhouse Street, E.C.1. To carry on business of proprietors of cold storage accommodation, etc. Capital: £1,000. Director to be appointed by subscribers. Subscribers: Ambrose C. A. Keevil, Thorpe Arnold, Landscape Road, Warringham; Christopher J. Freeman, Shenley Farm, Headcorn, Kent.

